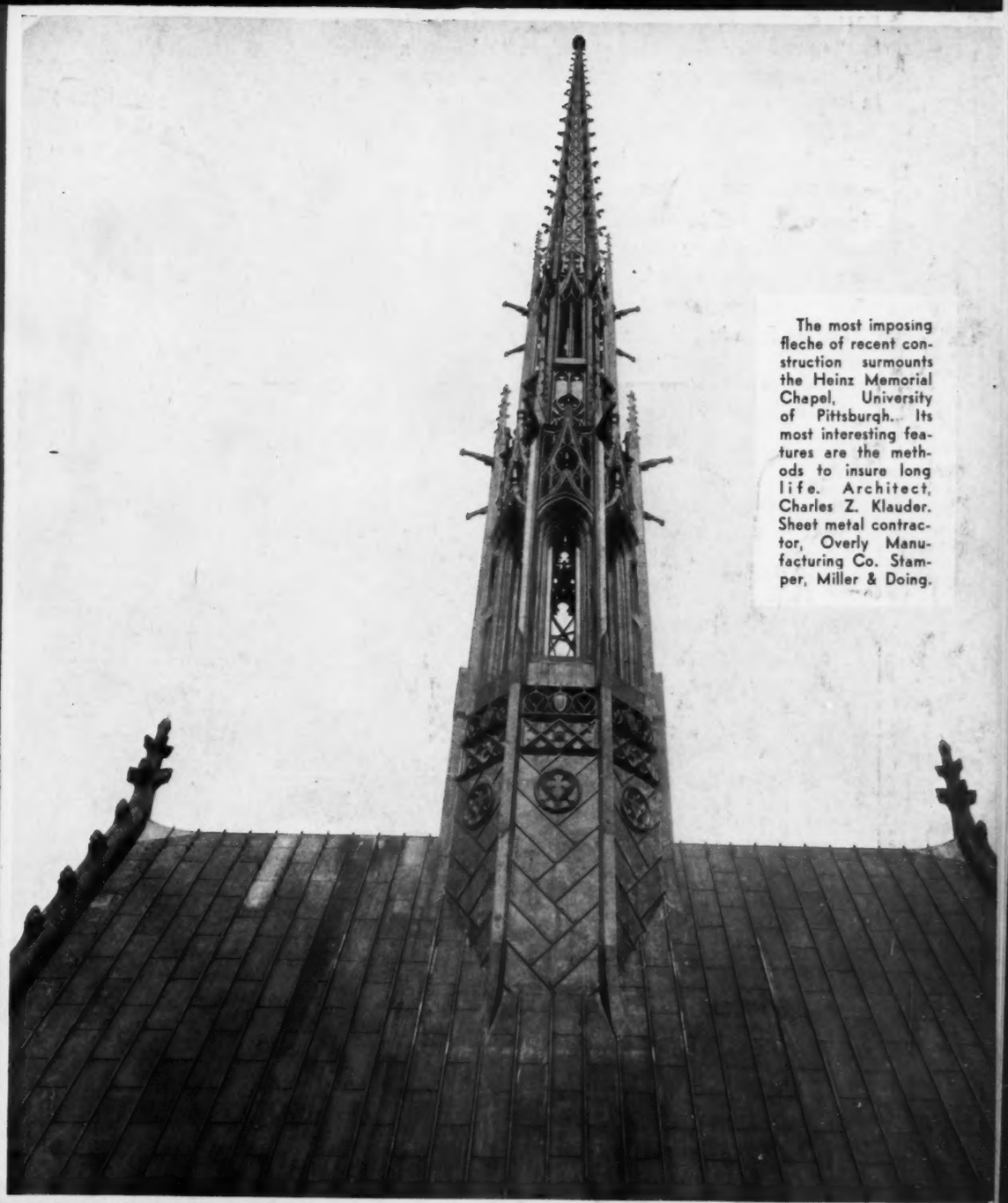
AMERICAN ARTISAN

WARM AIR HEATING • AIR CONDITIONING
SHEET METAL CONTRACTING



The most imposing fleche of recent construction surmounts the Heinz Memorial Chapel, University of Pittsburgh. Its most interesting features are the methods to insure long life. Architect, Charles Z. Klauder. Sheet metal contractor, Overly Manufacturing Co. Stamper, Miller & Doing.

ESTABLISHED 8 8 0

JUNE 1936

THE AIR CONDITIONING SECTION

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Only a Furnace System can deliver *effective* Summer Cooling *at low cost*

In This Issue

If you had a contract to fabricate and erect a fleche which must stand unaffected by weather for several centuries, what material and what methods would you recommend? The Overly Mfg. Co. of Greensburg, Pa., had such a contract; what they did is related on page 12.

*

There are several general types of dust collectors in use. J. W. Baybutt, on page 15, gives a summary of their individual points of merit.

*

When it comes to forming and stamping bright metal, many contractors run into difficulty because they do not compensate for the characteristics of the metal. Some practical suggestions on forming and stamping are reviewed on page 18.

*

The operating portion of the Social Security law (and the part in which costs are paid by the Federal Government) are included in Old Age Assistance. J. G. Dingle points out the effects of this part of the bill in the second article in his series. See page 21.

*

The popular interest in residential cooling this year is cooling with well or city water. Last summer the research staff tested this idea in the Research Residence. We publish on page 29 the first part of the results.

*

So much interest and so many inquiries were received on G. A. Voorhees' article on sizing ducts from a corrected friction chart that we asked him to write another article designing a complete system. You will find this valuable discussion on page 34.

*

Last month we published the first part of an article describing a practical method for calculating the cooling load. We continue the series on page 38, covering sun effect, time lag and other important considerations.

*

S. Konzo on page 41 begins gathering his previous discussions together to show how these facts from the Research Residence can be used to design better heating systems

*

At the recent air conditioning conference in Urbana, Ill., Professor Kratz read a paper on the Factors Which Affect Comfort. The paper is one of the most complete and condensed discussions of why we are comfortable, we have seen. On page 48, is the first part of the paper.

AMERICAN ARTISAN

With which is merged

FURNACES and SHEET METALS AND Warm-Air Heating

Covering All Activities in

Gravity Warm Air Heating — Forced Warm Air Heating

Sheet Metal Contracting — Ventilating

Air Conditioning

J. D. Wilder, Editor

Vol. 105, No. 6 — June, 1936 — Founded 1880

CONTENTS

THE AIR CONDITIONING SECTION

Member of Audit Bureau of Circulations—Member Associated Business Papers, Inc.

Published monthly by Keeney Publishing Company, 6 North Michigan Ave., Chicago. Branch Offices—In New York, Room 1950, Grand Central Terminal Building, Murray Hill 2-8293; In Cleveland, 2047 Rossmoor Road, Cleveland Heights, Yellowstone 1540; In Los Angeles, J. H. Tinkham, 1406 S. Grand Ave., Richmond 6191.

Yearly Subscription Price—U. S. and possessions, Canada, Mexico, South America, Central America, $2.00; Foreign, $4.00. Single copies, U. S. and possessions, $.25. Back numbers, $.50. January, 1936, Directory issue, $1.00 per copy. Entered as second-class matter, July 29, 1932, at the Post Office at Chicago, Illinois, under the act of March 3, 1879.

More than 7,000 Copies of this Issue are being distributed

General interior view in laundry showing more than twelve Monel Metal sorting and receiving tables. Every laundry plant in your city is a good prospect for Monel Metal tables.

Plenty of Chances in Laundries for YOU to make a

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Just look around any laundry or dry cleaning plant . . . you'll pick up a lot of jobs!

The Acorn Sheet Metal Works, Chicago, had a nice job when they made these 30 Monel Metal trucks for the American Linen Supply Co., Chicago. Monel Metal makes the most durable and satisfactory trucks. Call on the laundries in your territory and get your share of this business.

HERE'S a suggestion that has helped many a sheet metal contractor to develop sales from new customers.

The laundrymen in your town are well sold on Monel Metal. They buy a lot of Monel Metal *machinery*. They like it. They depend on it. It has proved to them that Monel Metal does not rust. That it's strong. That it wears for years. That it stays smooth, and splinterless and thus can't harm the clothes.

They know they ought to put in Monel Metal; that there are places in their plants that are causing them trouble which Monel Metal could cure. Here are a few of them:

Dry cleaning plants as well as laundries are good places to get sheet metal business in Monel Metal. Note the five Monel Metal dye tanks made by the Pico Metal Products Co., Los Angeles, Calif., for a dry cleaning and dyeing plant. In large dye-houses, Monel Metal is the standard material of construction for dye tanks and equipment.

In Laundries

Trucks, Table Tops, Chutes, Aprons, Soap Tanks, Utensils (such as buckets and dippers), Lining for Hand Tubs, Sorting Tables, Sinks.

In Dry Cleaning Plants

Trucks, Table Tops, Spotting Tables, Utensils, Dye Vats, Sinks, Ventilating Hoods.

Tear out this list. Check over these pieces of equipment, with every laundry owner or dry cleaner you can reach. If he owns a Monel Metal washer, you won't need to "argue" with him. He knows Monel Metal is good. Prove to him that you are good, too. A craftsman. That you understand how to handle Monel Metal and can turn out workmanlike jobs.

You'll pick up profitable business among these plants. Try it. Send for our free "Monel Metal Working Instructions." Write today.

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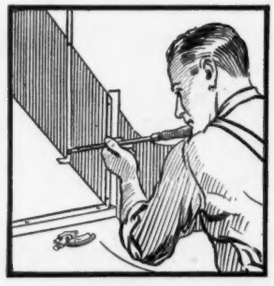
Originated and perfected over a period of 20 years by Parker-Kalon, the genuine Sheet Metal Screw can be depended upon to effect economy wherever you need to join or make fastenings to sheet metal that is not more than 18 gauge (.050″) thick. (For heavier metal, use Type "Z" Sheet Metal Screws.) With genuine Sheet Metal Screws you need only punch, pierce or drill holes in the metal and turn in the Screws. They *always* work right . . . go in easily . . . draw-up tight . . . make secure fastenings. Every genuine Sheet Metal Screw in a box is uniformly good.



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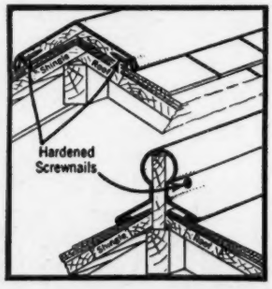
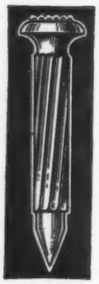
. . . *for fastening sheet metal securely to wood*

Where you want to fasten sheet metal *securely* to wood use Parker-Kalon Hardened Screwnails. They hold like screws, but drive like nails . . . make it unnecessary to use costly, time-consuming wood screws, or to take chances on common nails. Having a hardened needle point, a Screwnail eliminates punching in most cases. It drives right through metal. Then the hardened spiral threads cut into the metal and worm their way into the wood. A Screwnail won't loosen or back out. It gives you *strong* fastenings at low cost.





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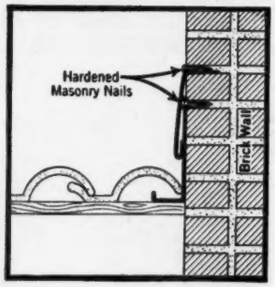
. . . *for fastening to brick, concrete, etc.*

These nails offer a simple, inexpensive, yet thoroughly satisfactory means of making fastenings to brick, concrete, and other masonry. They are easier, quicker and cheaper to use than expansion bolts, lead anchors and plugs, hooks, spikes and other expensive devices. Hardened Masonry Nails not only cost less, but also they usually do away with drilling and the use of shields, screws, etc. It is only necessary to hammer Masonry Nails into the material, the same as an ordinary nail is driven into wood. A small starting hole must be drilled only when using the larger sizes or in using the Nails in concrete or other hard masonry.



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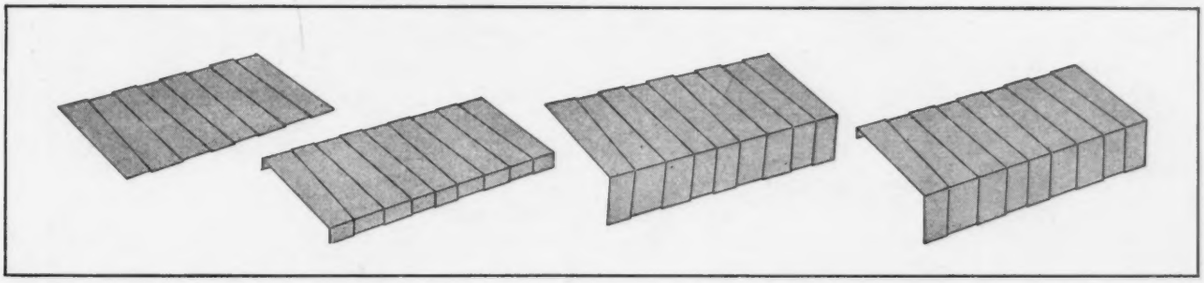

Throughout the country, millions of feet of Cheney Flashing are giving permanent protection from leaks and seepage. Cheney is the time-tested through-wall copper flashing that architects know and specify.

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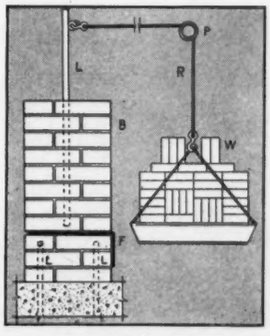
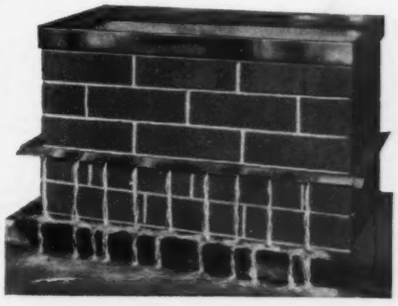
The patented Revere Thru-Wall Flashing is also available at very reasonable prices. For descriptive booklet of Cheney and Revere Thru-Wall Flashing, address our Executive Offices, 230 Park Avenue, New York City.



Masonry Bond Test (left) Two tests were conducted, one with Cheney Flashing, one with plain copper. Weights were added until wall fractured. Test with Cheney Flashing showed wall had a Modulus of Rupture of 27 pounds per square inch compared to 9 pounds per square inch for copper having no vertical bond. Before wall could be pulled over, mortar in Cheney keys had to be sheared off, proving an effective mechanical anchorage.



Drainage Test (right) Water equivalent to cloudburst precipitation, about 24 inches per hour, was poured into bottomless pan. In 37 seconds the water flowed out of standard-construction brick wall over the flashing from each lower key, along the entire length of the panel. This proved that Cheney Flashing automatically provides its own weepholes.

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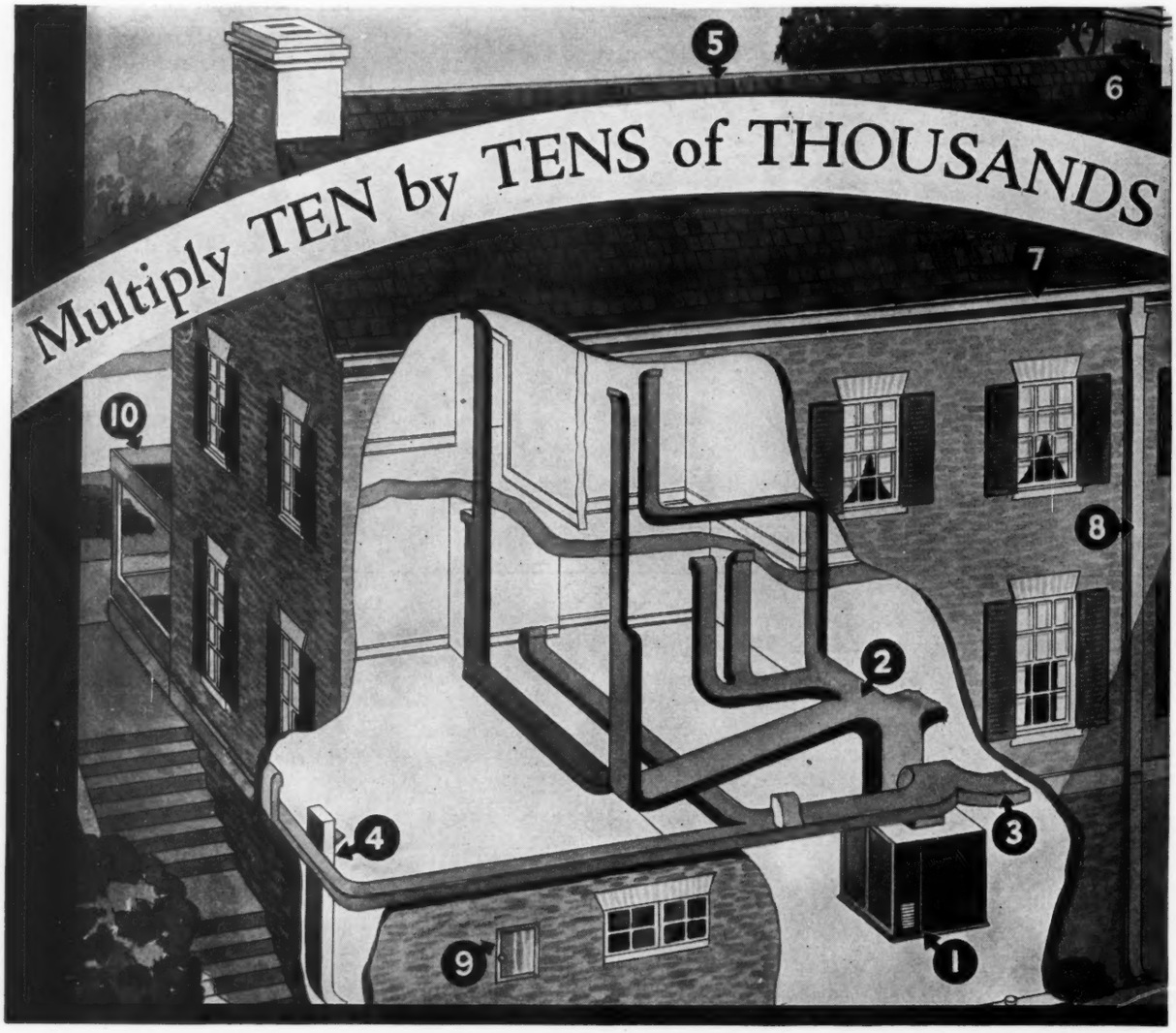

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Literally thousands of homes—both new and old—will face next winter with new gutter and spouting, new furnaces and air-conditioning, new roofs, and scores of other improvements or repairs. This year the business is there.

Next to going after it, your best business getter is A DEPENDABLE SOURCE OF SUPPLY—dependable from the standpoints of quality, of price and of delivery. OSBORN offers you this service on thousands of items, plus a 78-years old reputation for fair dealing.

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6 reasons why homeowners will buy
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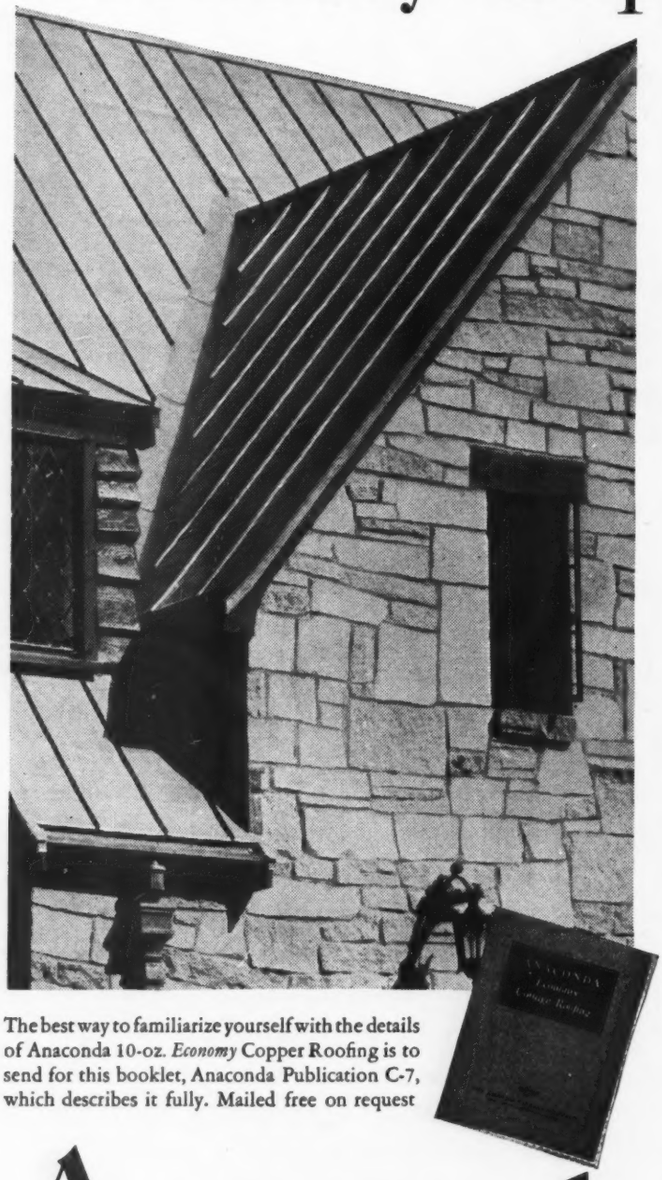

The best way to familiarize yourself with the details of Anaconda 10-oz. *Economy* Copper Roofing is to send for this booklet, Anaconda Publication C-7, which describes it fully. Mailed free on request

Here's what the public gets from this new, lower cost standing seam roof. Each one of these advantages is a profitable selling point for you:

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AMERICAN ARTISAN

Volume 105 Number 6

What Price Summer Comfort?

As we view the residential cooling situation from the background of several years' experience, we find a widespread feeling that cooling is not for the home owner.

How did this idea come to pass?

Perhaps a very brief review of the situation will help to clarify the thinking.

Most of us remember how enthusiastically we embarked on the sale of residential cooling three years ago when homeowners first began to ask us how much cooling cost. In those first days of residential cooling an installation cost plenty. Very few manufacturers had apparatus sized down to the home market. Further to complicate the situation, both the home owner and the contractor thought of cooling in terms of 72 degrees regardless of how hot it was outdoors.

As the problem began to clarify itself and research brought out facts which showed how impractical our first suggestions were, we hailed with enthusiasm new schools of thought as they came to our attention. In the past three years we have watched our initial and operating costs for a residential cooling installation fall steadily as we have proved the practicability of these following ideas:

1—Zone cooling (in which one or two rooms are cooled at a time and the full capacity of the cooling plant is thrown into the zone of immediate occupancy.)

2—Night air cooling (in which a fan in the attic or the speeded up furnace blower introduces enormous quantities of air through the house and brings inside temperatures at night down as outside temperatures drop.)

3—Water cooling (in which existing or new wells producing cold water, or cold municipal water, is used in coils to reduce the temperature of the recirculated air of the house.)

4—Cooling along a set differential curve (in which we keep inside temperatures a pre-selected number of degrees below outside temperatures rather than at a pre-selected inside temperature. By this plan we need smaller apparatus and less frequent operating cycles.)

5—Proof of the fact that awnings outside windows, double windows where cooling is used, insulation of second floor ceilings, insulation of walls, drawing of window shades in morning and afternoon and other inexpensive ideas really reduce the cooling load tremendously.

It is difficult to say just how much adoption of all or some of these practical ideas reduce the cost of summer cooling. Undoubtedly, they all or each one reduces the cost and brings cooling within the financial reach of thousands of additional owners.

But despite the fact that everyone engaged in selling cooling appreciates that our present cooling recommendations cost far less to own and operate than the systems of five years ago, the feeling persists that cooling is and always will be beyond the reach of the average owner.

We believe that this one practical, saleable and highly important fact is too often overlooked.

People will do almost anything to be comfortable in summer.

Consider this for a moment. When the temperature is below zero in the winter, we put on more clothing, fire up the furnace, make our trips outside as short as possible, draw the chair up to the register, put a fire in the grate, crawl into bed and pile on the bed clothing —any or all of which results in our keeping warm.

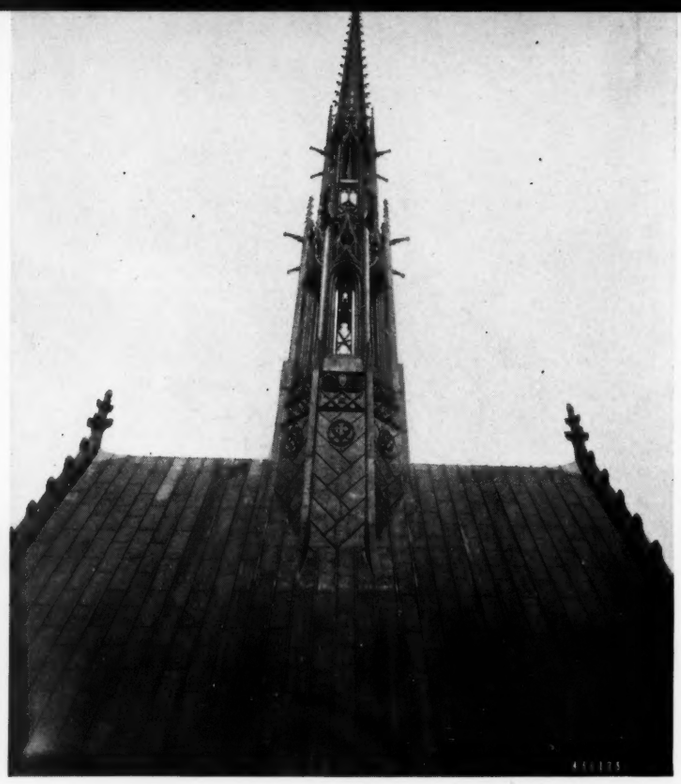
But when the temperature flirts with 100 what can we do? No matter where we go, no matter how much we take off, no matter how still we sit, no matter how many gallons of ice drinks we consume—we're hot. There is only one possible source of relief—some place which is artificially cooled.

Give any healthy human five nights in a row when the temperature is above 85 and his bedrooms are still hotter and that individual can't eat, can't sleep, can't think—isn't fit to live with.

In that condition, any person will listen to cooling—and buy—if the suggestions offered have any reasonable basis of cost.

If we acknowledge that cooling costs (initial and operating) have come down either as a result in lower prices of apparatus, or because of money saving ideas we have developed, then for that great portion of the country where summer weather is almost unbearable for from 30 to 90 days in the year, we surely cannot say without thinking "Cooling is not economically sound."

We believe that cooling is economically sound for large numbers of home owners. If we sit by and do nothing about the market, of course, we won't make any money from cooling. But if we keep on trying to find the home owner who thinks our suggestions are worth the comfort he will get and if each year we take advantage of the ideas which reduce cost, eventually this industry will have a profitable cooling business.



The Heinz Memorial Chapel Fleche

WITHOUT doubt the most imposing and largest fleche erected in this country in the past two years is the recently completed spire on the Heinz Memorial Chapel on the campus of the University of Pittsburgh in Pittsburgh. Ornamental in the extreme, the towering fleche and the beautiful chapel which it surmounts occupy a prominent central point in the campus.

The history behind the design of the building and the selection of the materials of the fleche is interesting. Erected in memory of the late H. J. Heinz, and of his mother, Howard Heinz personally visited numerous similar structures in Europe and in this country in deciding upon construction features and materials which would guarantee a building which will stand for centuries unaffected by time and weather.

The architect is Charles Z. Klauder of Philadelphia, noted for his modern Gothic designs. The sheet metal firm which participated in the preparation of practical plans and the selection of materials to meet the rigid specifications is the Overly Manufacturing Company of Greensburg, Pennsylvania. Stamping of the thousands of metal sections was done by Miller and Doing of Brooklyn.

Must Last Centuries

After the architect had prepared the design, the selection of a covering material involved research and investigation covering many months.

Conferences between Mr. Klauder, the architect and J. H. Goodwin, chief engineer of the Overly Manufacturing Company developed suitable plans whereby 32-ounce lead coated copper with a 25-pound lead coating on each side could be used at a great saving in weight and so fabricated and erected that the metal cover can be removed in sections for future maintenance.

Explaining this interesting part of the design, W. F. Overly says, "Mr. Heinz was not only interested in the present appearance and durability of the structure, but was also concerned with the lasting qualities of the structure and materials in the centuries to come. Our engineering department developed a type of construction whereby the lead coated copper covering can be removed from the steel structure without damage and be re-applied without requiring new parts whenever painting of the steel work is undertaken.

"The details of this unusual construction are, we believe, entirely original with our engineers, as we have never heard of such a proceeding in our many years in the architectural sheet metal business.

"We found that the structural steel framework, which had already been erected to accommodate covering material applied in the customary manner had to be reconstructed and many additional parts and sections added in order to give us the proper bearing for the metal sections of the cover. These additional requirements were willingly supplied.

General Description

"The fleche is 113 feet 5 inches high from the ridge of the superstructure; is 12 feet in diameter at the base of the octagon and 5 inches in diameter at the top of the octagon. The ridge which the base straddles is itself 125 feet above grade. In developing methods for removing cover sections for maintenance, we faced the problem of the preser-

vation of the structural work for the top 25 feet where the inside diameter is too small to permit a workman to enter for the purpose of removing the copper covering. The final solution resulted in a structural framework of bronze members in this top 25 feet. The cover at the top, therefore, should never have to be removed and the frame will not deteriorate.

"From the architects' sketches and drawings, we prepared one continuous scroll 116 feet long on which the full sized details were shown. As can be seen from the photographs, this 116-foot detail of one face was used for all eight faces, all of which are identical."

Construction of Parts

The accompanying drawing shows the general design and construction of the respective parts. At the elevation points suitable notation numbers have been incorporated. The construction of these sections is described as follows:

"The finial base (point 1) is an octagon made in four pieces stamped with two faces in each section. The spire throughout section 2 consists of duplicating panels between hips with each panel progressively reducing in width and height as required for the reducing diameter of the spire. Each crocket was formed in two halves, each set of eight crockets graduating proportionately from top to bottom.

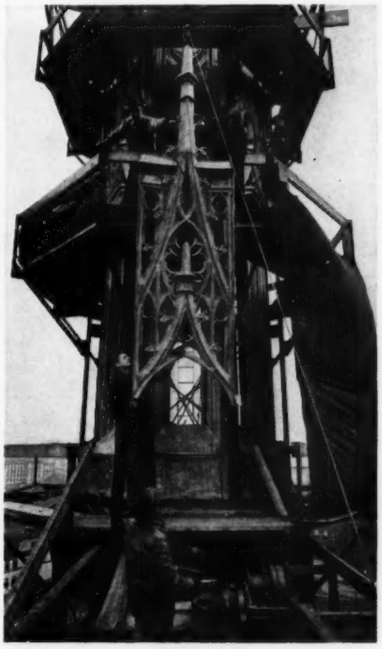
"The pinnacles at point 3 (eight in number) are 3 feet 6 inches high and were stamped in quarters of the full heighth. These pinnacles are four sided and stand separately from the spire with a covered flying buttress joining the pinnacle to the spire at the base of the top portion which is ornamented with small crockets.

"Point 4 shows Gothic panels forming the base of the top spire. These panels were stamped as halves (front and back) and connect along the bottom to the metal behind the free standing panels of point 6.

Gargoyles, Pinnacles

"At point 6 the large Gothic tracery panels stand clear of the spire and are double faced rather than open or flat backed as in usual construction. The attention to detail and perfection shown by this construction is typical of the entire fleche. These panels connect to the buttress covers to form open windows.

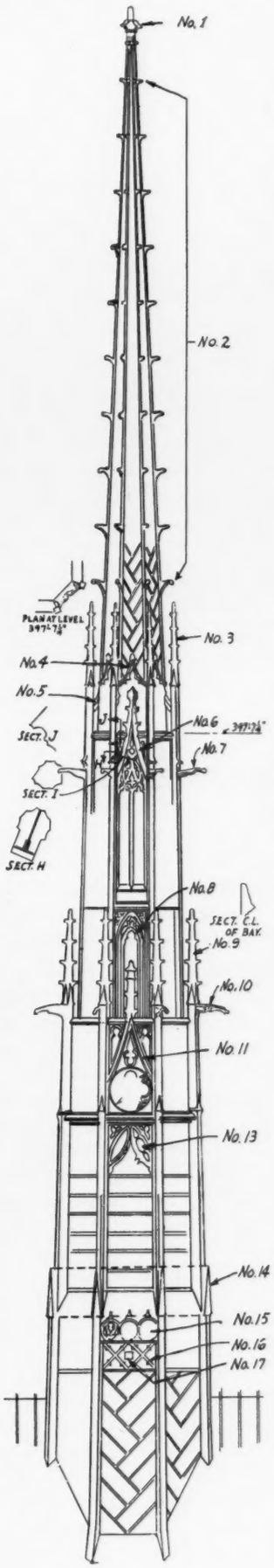
(*Continued on page* 80)

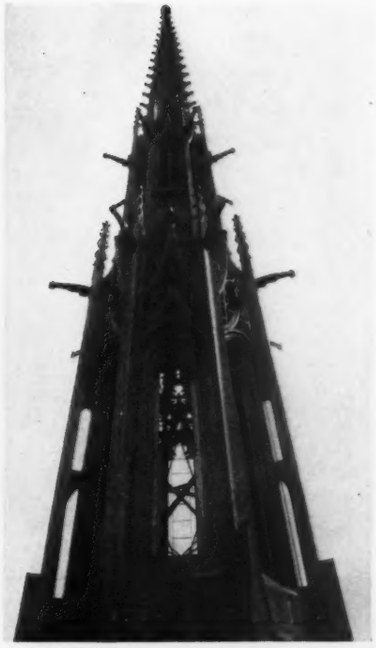


Tracery sections were supplied Overly in many small pieces. These were soldered into complete panels like this one, for erection.

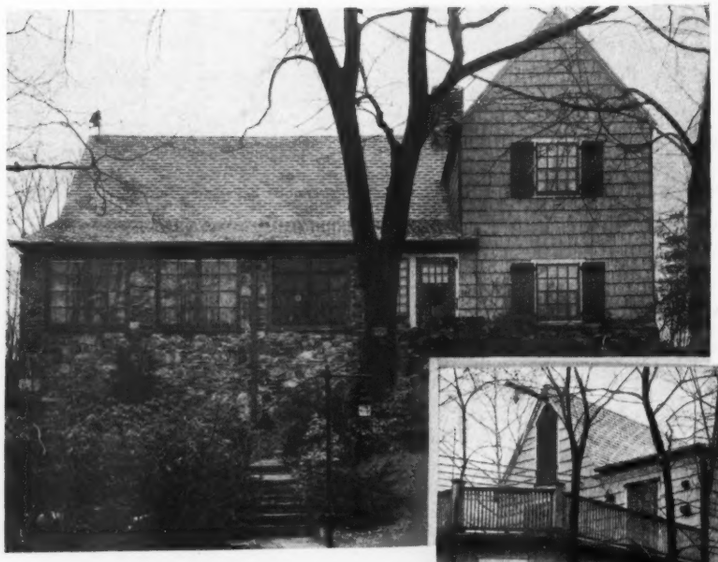
◆

Right—The various sections of the fleche where interesting design and erection details were encountered are shown. The drawing also shows the metal application.





Closeup of the spire from a point below the lower opening elevation. Face unit construction in indicated.



The long sweep of the roof as viewed from the street is pleasingly broken into short lines of light and shadow by the heavy butts of the copper shingles. The roof would probably have been unattractive without this effect.

Below—The roof from the rear (and the view from the front, also) shows how pleasingly the copper shingles blend into the lines of the siding shingles. The shingles, factory patinaed, were manufactured by the New Haven Copper Co.

A Copper Shingle Roof

If the average homeowner, remodeling or building a new house, could be persuaded to select his roofing material with as much thought as he chooses bathroom fixtures, better and more permanent roofing materials would very quickly forge to the front.. This article should be proof of the attractiveness of one type of metal roof.

EDMUND C. GAUSE, of 544 Pelham Manor Road, Pelham Manor, N. Y., recently observed that for the second time in a matter of ten years his home was in need of re-roofing.

Mr. Gause is a member of a firm of accountants, Haskins & Sells, New York City, and probably because of his profession has formed the habit of distinguishing clearly between first cost and value. At any rate, he decided that the first two roofs on his home had been reasonable in first cost—but very high in cost measured in terms of service.

"This time", said Mr. Gause, "I will take the advice of a good roofing contractor in whom I have absolute confidence. I'll tell him I want a roof that will last—if possible—longer than my house itself—a roof that will be as attractive when old as when new.

So this home owner called in Milton Riesner of Benjamin Riesner, Inc., 353 East 78th St., New York, who do a great deal of work in Westchester County and enjoy an enviable reputation throughout the East. Mr. Riesner recommended a roof of copper shingles, laid over the two old roofs. He explained that copper, properly laid, will outlast the building it protects. Mr. Gause quickly assented too because he remembered that the copper flashings and gutters put on when his home was built were still in perfect condition though the rest of the roof had been replaced twice, and insisted on a heavy gauge shingle. The first cost was secondary to permanence. When this home owner learned that he could obtain shingles from the factory in the beautiful green patina copper usually attains, only after years of weathering, his decision was settled. Recently Mrs. Gause wrote to the manufacturers, "We have received many favorable comments on our roof. Our friends tell us there isn't a roof in Westchester County as beautiful as ours."

Dust Collecting

By J. W. Baybutt
Instructor, Rochester Athenaeum and Mechanics Institute

MANY methods have been used in an effort to remove suspended matter from air. Some methods are much more efficient than others, but as a general rule the efficiency of dust removal varies directly as the cost of installation and maintenance.

A few of the more common methods are—the low velocity, centrifugal, dry type, which includes paper, cloth and baffling surfaces; the viscous surface, such as liquid coated steel, glass or vegetable matter; so-called water spray air washers and scrubbers; special design fans; and electric precipitation.

Probably the method most generally used for large amounts of dust is the centrifugal idea commonly termed dust collectors or separators. This type offers a good solution for removing large amounts of dust with relatively low maintenance and operating costs. From my own experience, however, based on testing a number of the various centrifugal types as illustrated in Figs. 1, 2, 3, 4 and 5, I would not be inclined to guarantee sufficiently clean delivery air from this type for human consumption.

These collectors have been made in various shapes, some of which are shown. Wide variations in design of top, outlet, inlet, shape of cone and inside arrangement have been used by the different manufacturers with about the same result as far as my observation could detect. In a series of test runs on recovery of valuable dusts, the design shown in Fig. IV (which I believe is patented) proved to be fairly efficient in amount of dust recovered. This efficiency statement may immediately raise the question as to what method was used to determine the percent recovered. There have been many ideas and schemes used to determine efficiency of filters, but I believe that for relative efficiency of numerous types the method used on this job is a reasonable one. We weighed in the dust supplied to the system and checked the recovered weight. This scheme would not be definite on an actual installation, but as a test on numerous types it offered more information than just guesswork or opinion.

Fig. VI and accompanying table lists a few of the important dimensions of collectors noted and used by the writer on wood dust recovery installations. The resistance offered by these units, dimensioned as per the table, has been from 1-inch to 1½-inch water S. P. This resistance, of course, is based on the usual velocity of about 3,000 F.P.M. in the entrance pipe.

For light dusts the writer would be inclined to increase the size of collector as against the sizes shown in the table. For buffing lint some authorities believe an outlet collector velocity should be 300 to 400 F.P.M, which, of course, would demand a much larger unit than called for in these tables.

Fig. VII shows a type used where dust and shavings need to be separated. Inspection of the screen is needed periodically with this type for best operation.

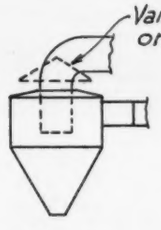


Fig. 1

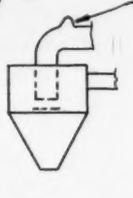


Fig. 2

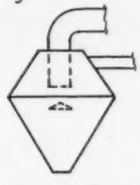


Fig. 3

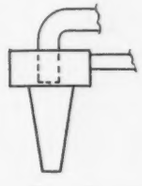


Fig. 4

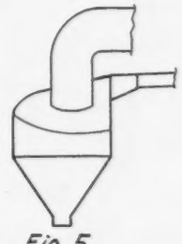


Fig. 5

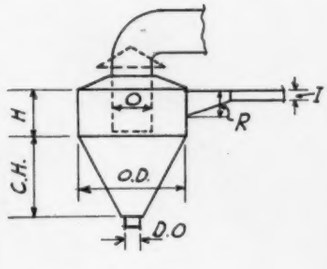


Fig. 6

I	R	O	D.O.	O.D.	H	C.H.
12"	21"x5½"	24"	8"	64"	26"	56"
14"	24"x6½"	28"	8"	71"	30"	64"
16"	30"x 8"	32"	8"	78"	35"	72"
18"	32"x 8½"	36"	10"	84"	39"	78"
20"	35"x 9½"	40"	10"	90"	43"	84"
22"	41"x 10"	44"	10"	96"	48"	90"
24"	43"x 10½"	48"	12"	102"	52"	95"
26"	48"x 11"	52"	12"	110"	55"	101
28"	54"x 11½"	56"	12"	118"	60"	109
30"	60"x 12"	60"	14"	126"	66"	116

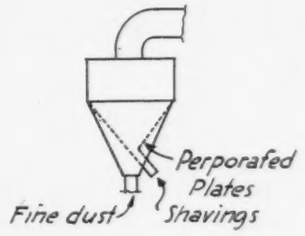


Fig. 7

A Welded Steel House of Panel Construction

Numerous types of steel houses have been introduced during the past four years. A favorite idea is the panel construction which permits factory fabrication and field assembly. This steel house was developed by Hobart Bros., welding equipment manufacturers. The page facing shows progress views.

THE Federal Government and all sorts of organizations are trying to stimulate home building activity. Many economists think that in the building of homes lies one way out of the present situation. Homes by the thousands are needed, but up to now construction has been impossible because of high cost. A very interesting example of low cost housing has been developed by the Hobart Bros. Co., Troy, Ohio. It is a home which can be manufactured in the factory with skilled labor, erected in a very short time on the site—and be sold at a reasonable price to the public.

Layout

The house consists of a living room and dining room combination, kitchen, two full size bedrooms and a convenient bath. The steel panel sections are completely welded together in the factory, joined together on the job and are welded into one solid unit. It's steel throughout. Not a single piece of wood, not a nail can be found. Even the furniture is all welded metal construction.

In this house no framing was necessary. It was built entirely of sheet metal panels approximately 4 ft. x 9 ft. These panels were welded together, stiffened and braced inside by a patented bracing construction. All panels were fabricated in the factory by skilled labor and taken to the house and quickly erected. A thick blanket of insulation fills every panel and covers the ceiling sections to insure complete and perfect insulation. Insulation is inserted into the panels in the factory.

Heating

This house is heated with a forced air system with an air conditioning system which can be used in the summer for cooling if desired. Modern plumbing, hot water heater, water softener, electric lights, gas stove, radio, electric clock—and all modern devices are included. All outlets and pipes concealed.

In the past many steel houses have been of the square or box type. This steel house is of conventional design yet keeps that design so standardized that the house can be produced in quantities. The exterior or plan can be varied, without effecting the primary design in several ways—the construction method only is standardized.

Both inside and outside walls are finished by applying a special coating of paint directly to the smooth sheet steel surface. Then a layer of white silica sand is sprayed on to the surface coat, giving it a plaster or stucco effect. Any color can be applied to this surface by the paint spray method. This method of finishing the walls coupled to insulation eliminates the use of outside veneer and plaster or wallboard materials on the inside. The floors of the house may be concrete or steel. The house may be built either with or without a basement depending upon the original cost desired. All carpets and linoleum are cemented directly to the concrete or steel floors, giving a very durable and satisfactory surface.

The weight of steel involved is 22,000 pounds. Sections have dimensions of 4 ft. x 9 ft., made of 20 guage material, foundation 30 ft. x 30 ft.

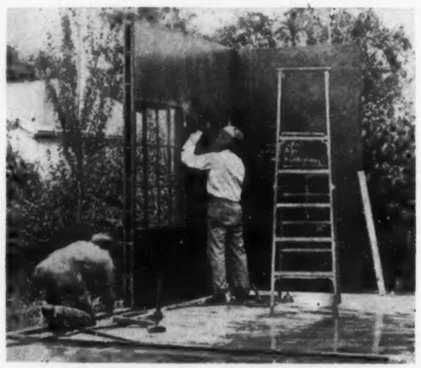
Cost

It was the aim to build a five-room house complete at a cost of $3,000 to $4,000 arranged as follows:

Actual steel, ready to assemble	$2,000
Erection	400
Plumbing and Heating	400
Wiring and Painting	300
Foundation (less basement)	200
Lot	300
	$3,600

The above is given as approximate figures. The prices will fluctuate according to the amount paid for the lot and according to whether the builder wishes a basement or not, which cost would, of course, increase the above figure.

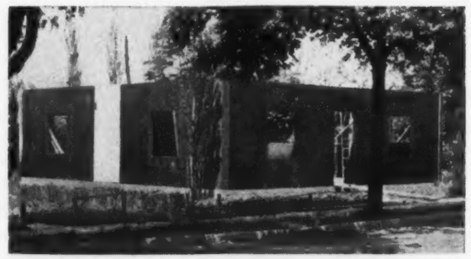
Right—Photograph of the finished house with paint and landscaping completed. Picture shows what can be built for less than $4,000



Above—A wall panel set up. Welder is fastening steel window frames, while a mechanic is preparing foundation for another panel.

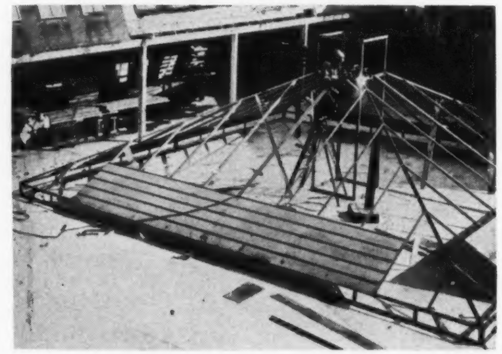
Above—Walls are in place; three-quarters of the roof is on and the other quarter-roof assembly is being raised into place. Note that roof section comes ready for erection from the factory.

Below—The foundation and walls are up; welding is finished on wall panels and window frames will next be installed.

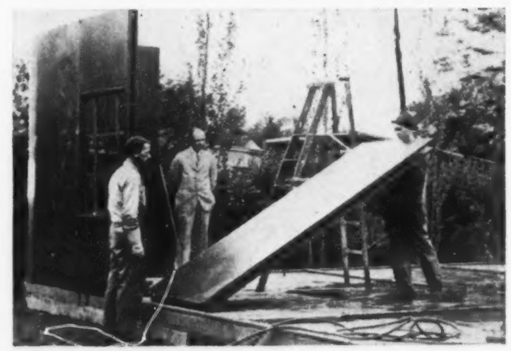


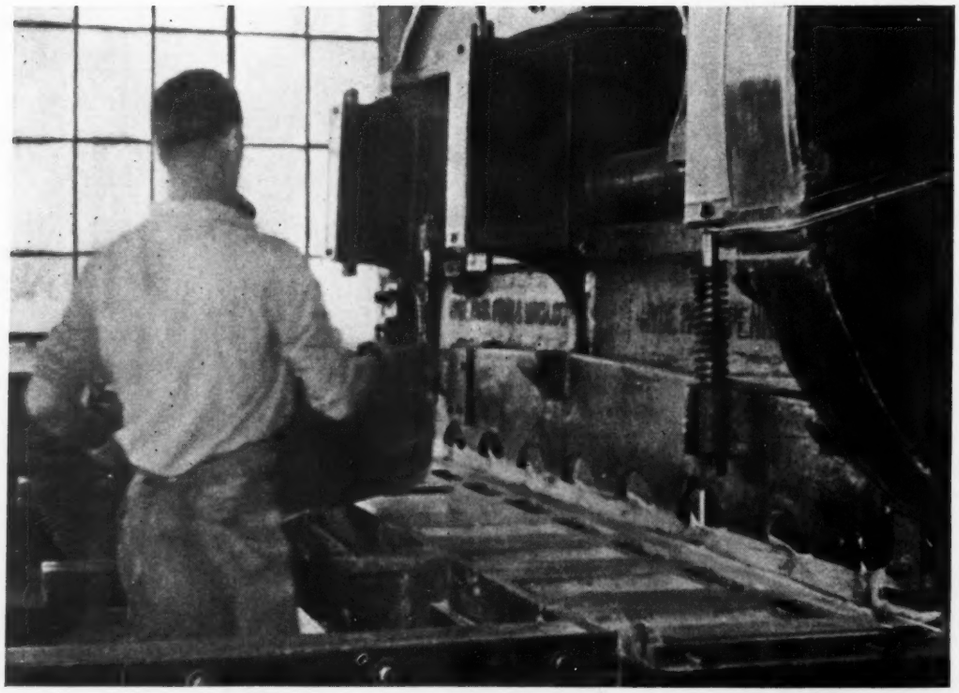
The Hobart portable welder is generating power for the mechanic spotting in the door frame.

Below—Assembling the roof framing in the factory yard. In the front section the metal roof is being applied. Factory fabrication insures correct fit. All pieces are welded.



Below—Showing the light weight of a wall panel. The insulation has not yet been applied. These thin, insulated, walls are a feature of the house design.





The die faces of this forming press are covered with heavy cloth to protect the polished surface. Photograph by courtesy of Republic Steel Co., from moving picture "Enduro."

Forming and Stamping Bright Metal

THE fabricator of specialty products using bright metals day after day sets his equipment for best production or buys machinery especially adapted to meet the characteristics of the material, but the average shop owner accustomed to using galvanized iron and the softer metals, frequently runs into difficulty when he attempts to use his equipment on bright metal without making the changes which mean the difference between satisfactory and unsatisfactory fabrication.

The foregoing seems particularly true of those forming operations requiring the brake or die drawing machine. Yet there should be no difficulty in forming bright metal if the fundamental characteristics are taken into account.

In the January, 1936, issue in the first article of this series, there appeared a tabulation of the important characteristics of various trade named bright metals. In the column headed "Cold Working Properties" it was noticeable that most of these metals showed "good" properties with an occasional entry such as "stiff," etc. This characteristic of the bright metals did not just happen. Quite the contrary, the manufacturers have spent much money and thought in perfecting bright metals of different characteristics so that practically every ordinary or unusual requirement has a material especially suited. Where certain peculiar properties are demanded, the manufacturers have been explicit in pointing out that the material possessing these characteristics differs from ordinary bright metal and should be handled according to carefully worked out practices.

In view of the fact that these articles deal with the use of bright metal for our customary metal applications we will not, here, treat of those particular materials or applications where special metals are required.

The 18-8 Metal

The commonest type of bright metal used for architectural work, for such products as restaurant equipment, tanks, containers and products used by industries not having acute acid or chemical conditions is the type of bright metal commonly known as 18—8. The designation 18—8 is derived from the metallurgical analysis which shows about 18 per cent of chromium and about 8 per cent of nickel. The common working properties of this metal are excellent ductility, imperviousness to common weathering and chemicals, unlimited degrees of polish, ease of welding (both electric and gas) comparatively easy forming and good drawing characteristics.

In the Brake

When bright metals of the 18—8 grade are formed in the brake or press it should be kept in mind that while the material is highly ductile it nevertheless is extremely tough and from two or three times the power required for mild steel may be required at the machine. Another characteristic is rapid work hardening. In other words, when most 18—8 metals are bent or subjected to stress the metal hardens at the point of stress, becomes tougher, and unless the operation is performed uniformly and in the correct man-

ner the machine must exert needless power in the operation.

There is practically no difference in brake operations. More power is required, but the common bends used for corners, seams, moldings are as readily made in bright metal as in softer materials. The outstanding precaution to be observed is to protect the polished surface. Some contractors cover the clamping bar with paper or cloth; others leave the protecting paper or cloth on the sheet. In folder or brake it has been found good practice to cover the bending leaf with paper or cloth, especially where the polished surface must be put through face down.

Because this material is tougher, it is necessary that the pressure of the clamping bar be firm and uniform and adjustments to secure this uniform pressure should be made rather than chance slippage through haste.

Paper on Sheet

When the polished surface is worked against the machine, many contractors make a practice of covering the greater surface of the metal with heavy paper pasted onto the metal with a flour and water paste. Practically any heavy paper (but not a glazed or waterproof paper) is satisfactory. The paper is removed after the forming operation by washing in water. Practically all of the manufacturers recommend covering the face of the brake leaves with adhesive tape, as one sure and easy method of keeping the machine metal away from the polished sheet surface.

Die Construction

While the precautions for forming in the brake are comparatively simple, the recommendations for mild and deep drawing in presses is more complicated. First of all the dies themselves should be carefully made and matched (with a clearance about twice, say .007, as great as for mild steel work). Greater strength in the dies is recommended as greater pressures will be applied. Manufacturers suggest that cheap, carelessly made and finished dies will result in injury and make necessary tedious and costly polishing after formation. More money in dies, smoother die surfaces, correct clearances may cost a little more in the beginning, but save money in the end.

All dies should be carefully polished and die material of the non-deforming grades of deep hardening alloy tool steel are suggested. Dies should provide for from double to triple the spring-back encountered with mild steel. The press will have to exert more pressure (depending on the depth of the draw) hence a press working at its limit on mild steel will not perform for bright metal of the same gauge. Practice has shown that on power press work the machine should be slowed down. Split dies may produce scratches necessitating coarse grinding.

For most of the bright metals of the 18—8 class a maximum reduction of about 50 per cent can be obtained before annealing is required. In other words, a 10-inch diameter blank can be drawn in one operation into a 5-inch cup before annealing is needed. In annealing a temperature of 1900 to 1950 degrees is recommended, followed by an air cool. The article should be held at this temperature only long enough to insure thorough penetration of the heat. For final annealing use manufacturers specifications.

Lubricants

In all press operations lubricants and protection are absolutely essential. Some manufacturers recommend a water soluble solution for simplicity, but there are many kinds of lubricant which contractors have found satisfactory. The essential characteristic for any lubricant is that it possess a tough, heavy body able to stand up under the greater pressures and higher temperatures.

For heavy gauge material white lead thinned down with linseed oil to about the consistency of 600W engine oil is good. A 50—50 mixture by volume of linseed oil and sulphur is used by some operators. A mixture of castor oil and emulsified soap has been found good. A large number of specially prepared lubricants having lithopone base are available or similar lubricants can be mixed using the lithopone base. Such a mixture used by many contractors consists of lithopone, pale paraffin oil, number 2 cup grease, flour of sulphur and talc. Lithopone and linseed oil is frequently used or lithopone and paraffin oil, both mixed to a heavy consistency.

Removing Lubricant

The water soluble lubricants are removed with water, the lithopone base lubricants can be removed with benzine, kerosene or gasoline or with a caustic dip and scrubbing.

Where the draw necessitates annealing during the drawing operation all traces of the lubricant should be removed before heating to avoid the decomposition of the lubricant which causes trouble and a pitted finish. Sodium meta-silicate at 160—200 degrees is good, the strength of the solution depending on the adhesiveness of the lubricant.

In the Cutter Sheet Metal Co. shop bright metal being formed into restaurant equipment is protected by paper and cloth along the edges being turned.

Huge Collector Reclaims Cement and Sand

By R. C. Nason

THE large 12-gauge steel centrifugal collector here shown was installed recently by H. E. Knaup & Sons, Brooklyn, N. Y., at the plant of the Trinidad Paving Co., Flushing, L. I., and has performed valiant service in reclaiming cement and sand from a paving material mixer. Hoisting the separator 40 feet to position proved an easy task by railroad crane despite the 1½ tons weight of the sheet metal work.

From the Knaup shop, the collector was shipped in nine separate pieces, shop fabricated for assembly on location. Prior to assembly, the structural steel angle iron cradle seen was made and erected. An idea of the generous dimensions of the completed piece is indicatd by the maximum width of 15 feet and the height 27 feet.

A feature is the attachment of a circular, flat, or lateral, disc just under the base of the collector outlet pipe. The round pipe attached to the collector inlet is 36 inches in diameter.

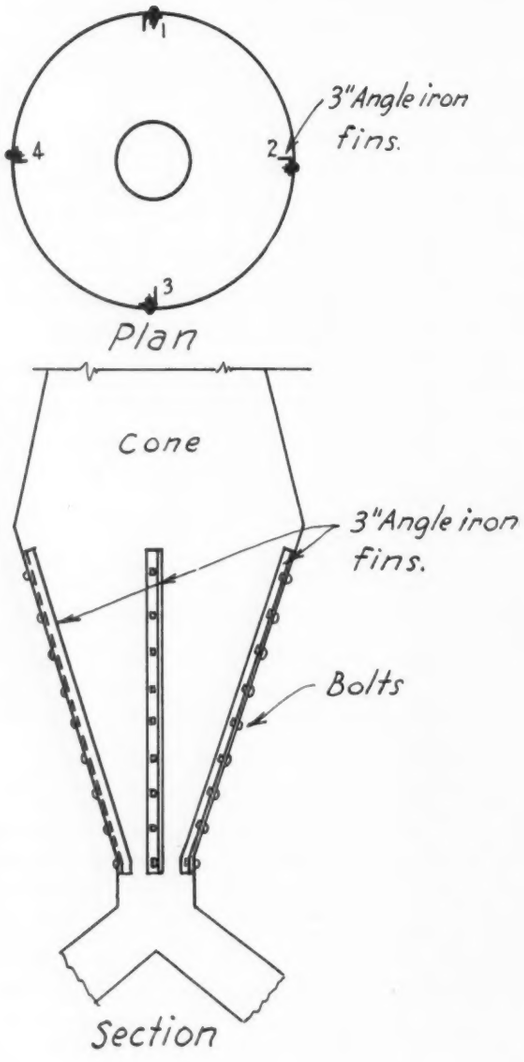
Near the base outlet of the collector is a large rotating drum in which road paving materials are mixed ready for use. Stone, sand and cement are among materials that pass through the drum. The sand here used, naturally, contains moisture, which is released by heat used in mixing and, to a degree, to smelt the materials of the mix. Along with the steam there also is released considerable amount of fine sand and cement dust.

A large exhaust fan gathers the rising steam, sand and cement dust, passing it to the collector for separation. The recaptured materials may be returned to the mixer drum or piled for future use by opening gate valves in two discharge ducts concerned.

To provide greater separation than usually is possible in plain centrifugal "cyclone" type collectors of this shape, H. E. Knaup & Sons bolted longitudinally within the collector cone four 3-in. angle iron strips spaced equally. These run from points near the top of the cone to just below the neck, or outlet connection piece.

As air action within the collector is centrifugal, impingement on the "fins" here described and shown interrupts circular air flow long enough to yield separation greater than can be effected within collectors not so designed.

Reclaimed material will soon repay collector cost thus justifying the modernization.



Social Security—

A Summary of Its Immediate Requirements

By Joseph G. Dingle
C. P. A., Ottawa, Ill.

ON August 14, 1935, there was placed in the Federal Statutes one of the most far-reaching and unusual pieces of legislation ever enacted by Congress. Far-reaching because the Federal Government outlines for the States legislation for "security" to countless millions; the aged, the unemployed, the blind, and the crippled and dependent chilren. Unusual because the Federal Government tells the several States that they must pass certain laws; must levy certain minimum taxes; that after these taxes have been collected they must be sent to Washington where the money may be safely kept; and after proper approval by the Federal Social Security Board, it may be sent back to the States to be disbursed.

Before going into a discussion of this act, let us first list the ten titles comprising this act:

I. Grants to States for Old-Age Assistance.
II. Federal Old-Age Benefits.
III. Grants to States for Unemployment Compensation Assistance.
IV. Grants to States for Aid to Dependent Children.
V. Grants to States for Maternal and Child Welfare.
VI. Public Health Work.
VII. Social Security Board.
VIII. Taxes with Respect to Employment.
IX. Tax on Employers of Eight or More.
X. Grants to States for Aid to the Blind.

From the above, it will quickly appear that the Federal Government has undertaken a great task. And further analysis shows that there is only one Federal benefit—costs of the others are to be borne by the several States.

First, there is the question of Constitutionality, so popular these days. Much has been written on the subject of the constitutionality of this act, and many predict that in the end, this act will meet the same fate as the NRA, the AAA and the Railroad Retirement Act.

Then, there is the very serious question of State Rights. Ours is a government of delegated powers to Washington, with greater powers reserved to our State governments.

◆ ◆

A series of articles on the so-called Federal Social Security Act, enacted into Federal law in August, 1935. The author, Joseph G. Dingle is well known by his previous articles on bookkeeping and by his close study of our industry. Mr. Dingle does not believe this act as established today is sound. He says—

"The idea of Social Security is not new. It does not come through the accumulation of wealth, nor will it come with the distribution of wealth. At one time a large portion of our people enjoyed a large measure of social security. They were the slaves of the Old South. When a black child was born, it was assured food, clothing and shelter until the day of its death. We, too, perhaps can obtain that degree of "social security" if we accept the present law as it is now written. The act is specific in its money raising clauses, but vague in its benefits and application. I suggest that every employer and employee study the act—even the 'fine print'."

◆ ◆

This act, claim opponents, is an attempt by Washington to break down resistance to a central, all-powerful government.

In view of the opposition and uncertainty, the following quotations are presented for serious consideration:

"Sec. 1—For the purpose of enabling each State to furnish financial assistance, so far as its practicable under the conditions in such State, to aged needy individuals. . . ."

"Sec. 2(a)—A State plan for old-age assistance must. . . ."

"Sec. 2(b)—The Board shall approve. . . ."

"Sec. 3(c)—From the sums appropriated therefor, the Secretary of the Treasury shall pay to each State, which has an approved plan. . . ."

"Sec. 4—In the case of any State plan for old-age assistance which has been approved. . . ."

"Sec. 301—For the purpose of assisting the States in the administration of THEIR unemployment compensation laws. . . ."

"Sec. 302(a)—The Board shall from time to time certify to the Secretary of the Treasury for payment to each State which has an unemployment compensation law. . . ."

"Sec. 303(a)—The Board shall make no certification for payment to any State unless it finds that the law of such State, approved by the Board under Title IX includes provisions for. . . ."

"Sec. 303(b)—Whenever the Board, after reasonable notice and opportunity for hearing to the State agency charged with the administration of the State law, finds that in the administration of the law there is

"(1) a denial . . .

"(2) a failure . . .

the Board shall notify such State agency that further payments will not be made to the State until the Board is satisfied that there is no longer any such denial or failure to comply."

"Sec. 401—For the purpose of enabling each State to furnish financial assistance, as far as practicable under the conditions in such State, to needy dependent children. . . ."

"Sec. 402(b)—The Board shall approve any plan which fulfills the conditions specified in subsection (a). . . ."

"Sec. 403(a)—From the sums appropriated therefor the Secretary of the Treasury shall pay to each State which has an approved plan. . . ."

"Sec 503(a)—A State plan for maternal and child health services must provide. . . ."

"Sec. 902—The taxpayer may credit against the tax imposed by section 901 the amount of contributions, with respect to employment during the taxable year, paid by him . . . into an unemployment fund under a State law. . . . The total credit allowed a taxpayer under this section . . . shall not exceed 90 per centum of the tax against which it is credited. . . ."

With these thoughts fresh in mind let us now take up for more detailed discussion the sections deal-

(*Text continued on page* 82)
See following page for Provisions

SUMMARY OF PROVISIONS OF THE SOCIAL SECURITY ACT RELATING TO FEDERAL GRANTS TO STATES

(Public No. 271, 74th Cong. [H. R. 7260]; Approved Aug. 14, 1935)

PROVISION	OLD-AGE ASSISTANCE (Secs. 1-6)	AID TO THE BLIND (Secs. 1001-1006)	AID TO DEPENDENT CHILDREN (Secs. 401-406)	MATERNAL AND CHILD HEALTH (Secs. 501-505)	CRIPPLED CHILDREN (Secs. 511-515)	CHILD WELFARE (Sec. 521)	PUBLIC HEALTH (Secs. 601-609)
Conditions for approval of State plan.	1. A State plan (for each type of assistance, aid, or service) must be submitted by the State to the designated Federal administrative agency for approval. For old-age assistance, aid to the blind, and aid to dependent children, each of the plans must be State-wide, and, if administered by political subdivisions must be mandatory upon them. 2. Financial participation by the State must be provided in the State plan (for each type of assistance, aid, or service). A State old-age assistance plan need not provide State financial participation before July 1, 1937, where the Board finds the State is so prevented by its constitution. 3. A single State agency must be established or designated to administer the State plan or established or designated to supervise the administration of the State plan. For maternal and child-health services the State health agency must be used. 4. Methods of administration (other than those relating to selection, tenure, and compensation of personnel) necessary for the efficient operation of the plan. 5. Reports must be submitted in such form and containing such information as may be from time to time required by the designated Federal administrative agency. 6. Persons whose claims for assistance have been denied must be permitted an opportunity for a fair hearing before the State agency.			6. Provide for the extension and improvement of local maternal and child-health services administered by local child-health units. 7. Provide for cooperation with medical, nursing, and welfare groups and organizations. 8. Provide for development of demonstration services in needy areas and among groups in special need.	6. Provide for carrying out the purposes specified in the appropriation. 7. Provide cooperation with medical, health, nursing, and welfare organizations and with agencies charged with vocational rehabilitation of physically handicapped children.	The conditions are those involved in the purposes of the section: To enable the United States to cooperate with the States in establishing, extending, and strengthening, in predominantly rural areas, child-welfare services for the protection and care of homeless, dependent, and neglected children, and children in danger of becoming delinquent. The amounts shall be allotted on the basis of plans developed jointly by the Children's Bureau and State public-welfare agencies and be expended for payment of part of the cost of local services in areas predominantly rural, and for developing State services for the encouragement and assistance of adequate methods of community child-welfare organization in areas predominantly rural and other areas of special need.	The conditions are those involved in the purposes of the act, which are to assist States "in establishing and maintaining adequate public-health services, including the training of personnel for State and local health work." The moneys paid to any State must be used solely in carrying out these purposes and in accordance with plans presented by the State health authority to the Public Health Service.
	7. State residence requirement may not exceed 5 years within last 9 years. One year of residence immediately preceding application may be required.		7. State residence requirement must not disqualify a child who has resided in the State for a year immediately preceding application, or who was born in the State during the preceding year, if its mother has resided in the State for one year immediately preceding the birth.				
	8. A State plan cannot impose any citizenship requirement which excludes any United States citizen.						
	9. After January 1, 1940, State plan must provide an age limit of not over 65 years, but until then a 70-year limit is permissible.	9. No aid to be given blind person while in receipt of old-age assistance under a Federally approved plan.					
	10. One-half of any recovery from estate of a recipient to be paid to the United States.						
Amount of Federal grant to State.	One-half of State expenditures for assistance under each plan; but payments in excess of $30 a month to an individual are not matched by Federal Government. Five percent of Federal aid to State for administration and/or assistance under each plan.		One-third of State expenditures; but payments in excess of $18 per month for first child and $12 for each additional child are not matched by Federal Government.	$20,000 to each State; and $1,800,000 distributed to the States in proportion to live births; and $980,000 distributed on basis of need, taking into consideration number of live births in State.	$20,000 allotted to each State and $1,830,000 distributed to the States on the basis of need taking into consideration the number of crippled children in need of such services and the cost thereof.	$10,000 allotted to each of the States and $990,000 distributed to the States not to exceed proportion of State to United States rural population.	$8,000,000 distributed to the States on the basis of (1) population, (2) special health problems, (3) financial needs.
Extent of State financial participation.	Amount equal to Federal payment to State exclusive of Federal 5 percent.		Amount double Federal payment to State.	Amount equal to Federal payment to State exclusive of allotment on basis of need.	Amount equal to Federal payment.	Not specifically provided in act.	Not specifically provided in act.
Federal definition of aid.	Money payments to needy individual 65 years or older not an inmate of public institution.	Money payments to needy blind individual not an inmate of a public institution.	Money payments to needy dependent child or children under 16 years by reason of death, absence, or incapacity of a parent, living with an enumerated relative in a residence maintained as a home.	Services for promoting the health of mothers and children.	Services and facilities for crippled children or for children suffering from conditions which lead to crippling.	See above under "Conditions for approval of State plan."	See above under "Conditions for approval of State plan."
Method of making allotments.	Allotments made for each quarter on the basis of estimated State expenditures and appropriations, and investigations by the appropriate Federal agency.					Not specifically provided in act.	Allotments made for each quarter in accordance with regulations previously prescribed after conference with State health authorities.
	Payments made to the State (at time or times fixed by the designated Federal agency) by the Secretary of the Treasury (through Disbursement Division) prior to audit or settlement by the General Accounting Office.						
Suspension of Federal grant.	In the case of an approved plan which the Board finds after reasonable notice and opportunity for hearing has been changed to impose a prohibited requirement; or in the administration imposes a prohibited requirement with the knowledge of the State agency in a substantial number of cases, or fails to comply substantially with the provisions required in the plan, the Board shall notify the State agency that further payments will not be made.			In the case of an approved plan which the Secretary of Labor finds after reasonable notice and opportunity for hearing fails to comply substantially in the administration of the plan the Secretary shall notify the State agency that further payments will not be made.		Not specifically provided in act.	Not specifically provided in act.
FEDERAL AGENCY	SOCIAL SECURITY BOARD	SOCIAL SECURITY BOARD	SOCIAL SECURITY BOARD	CHILDREN'S BUREAU	CHILDREN'S BUREAU	CHILDREN'S BUREAU	PUBLIC HEALTH SERVICE
Federal appropriation authorized—Fiscal year 1936.	$49,750,000	$3,000,000	$24,750,000	$3,800,000	$2,850,000	$1,500,000	$8,000,000

NOTE.—The Social Security Act also authorizes in section 531 an appropriation of $841,000 for the fiscal year 1936, to be distributed as grants to the States for vocational rehabilitation purposes, in addition to the appropriation available under the provisions of existing law; the Federal Vocational Rehabilitation Act is administered by the Office of Education in the Department of the Interior. The Social Security Act also authorizes in title III an appropriation of $4,000,000 for the fiscal year 1936, to be distributed as grants to the States for the administration of their unemployment compensation laws.

U. S. GOVERNMENT PRINTING OFFICE 16—6402

Note:—This summary of present provisions complied and released by the Federal Social Security Board covers those titles of the act under which the Federal Government is already making payments to states.

Note:—This summary of present provisions compiled and released by the Federal Social Security Board, [illegible] the Federal Government is already making payments to states.

AIR CONDITIONING SECTION

So many comments and questions were received on G. A. Voorhees' article in the January issue suggesting a method for sizing ducts from a corrected friction chart, that we have asked Mr. Voorhees to take a typical residence and size a complete duct system. You will find his article in this issue.

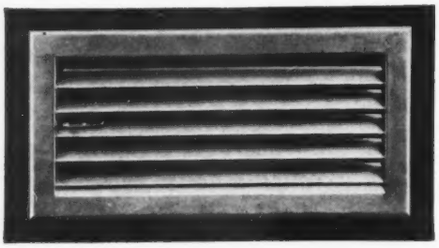
- - - This month's section is full of up-to-date information on cooling—articles on a method for calculating the cooling load; the results of tests on cooling using city water at the Research Residence; air conditioning system design for a large drug store.

- - - And S. Konzo gathers together the data from his previous articles and begins discussion of how to make use of these facts in the procedure of designing an installation.

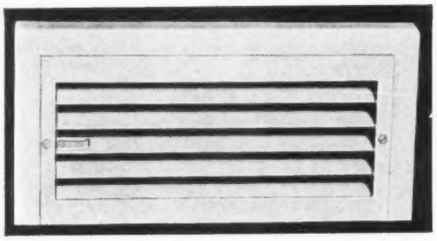
- - - Contractors up against radiator heat competition will find useful data in Professor Kratz's paper on "Factors Effecting Comfort."

WATERLOO

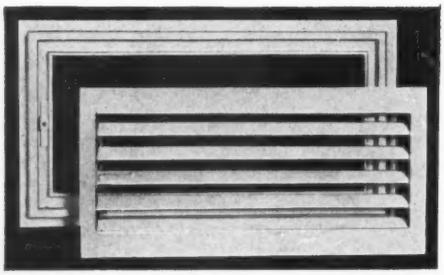
Air Conditioning REGISTERS



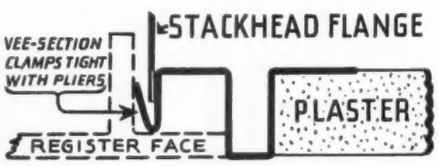
FH-100—Adjustable one-piece Venetian Type Register for walls.



FHD-204—Two-piece Venetian type adjustable register for baseboards.



FH-102—Venetian Type adjustable register for walls, with Vee-U plaster frame.



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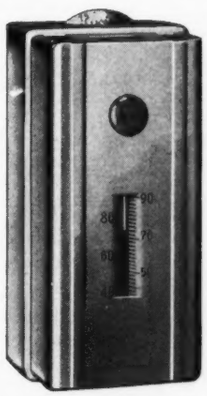

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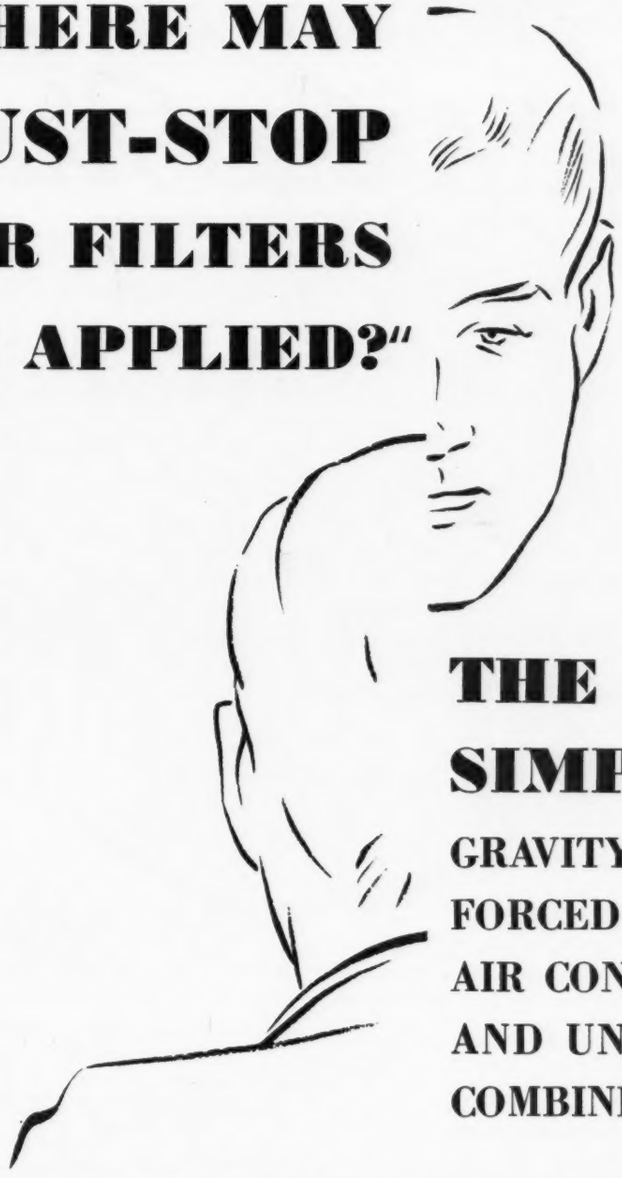

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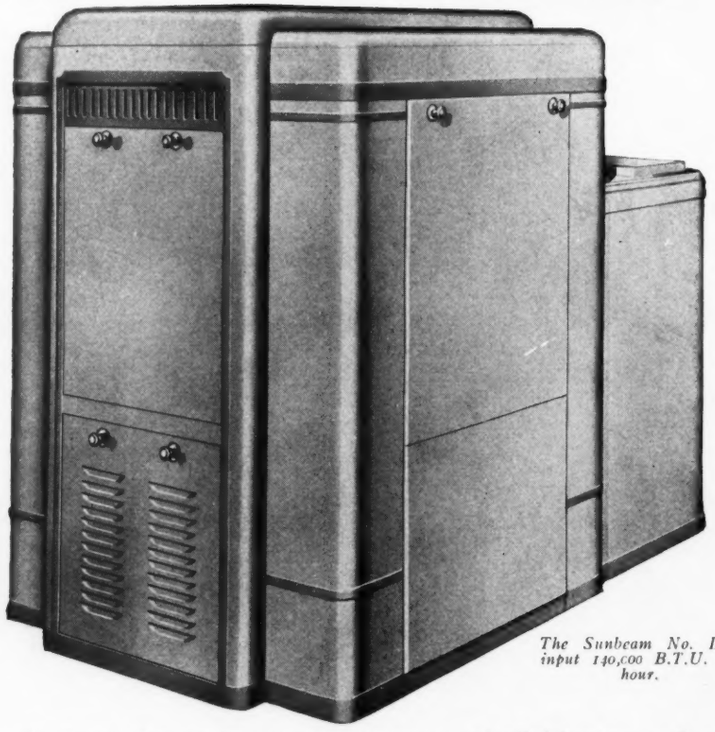

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Study of Summer Cooling in the Research Residence Using Water from the City Water Mains§

By A. P. Kratz,* M. K. Fahnestock,** S. Konzo,† and E. L. Broderick‡
Urbana, Ill.

This paper is the result of research sponsored by the American Society of Heating and Ventilating Engineers, in cooperation with the National Warm Air Heating and Air Conditioning Association and the University of Illinois, and conducted in the Research Residence at the University of Illinois.

PREVIOUS investigations in summer cooling in the Research Residence during the summers of 1932,[1] 1933,[2] and 1934[3] made use of either ice as the medium for cooling water circulated through coils placed in the forced-air heating system or a two-ton mechanical refrigerating unit used in connection with evaporator coils placed in the forced-air heating system. These investigations were confined largely to studies of certain factors affecting the cooling load, and to studies of the effectiveness of different methods of circulating air from the outdoors at night, both as a supplement to artificial cooling during the day and as a means for eliminating the necessity for artificial cooling during the day. The investigation for the summer of 1935 was undertaken to determine to what extent water from the city water mains, available at a temperature of from 58 to 60 F, could be used to produce satisfactory cooling and dehumidification in the Research Residence when supplemented by the circulation of outdoor air through the second story at night and when approximately one air change per hour of outdoor air was used for the purpose of ventilation during the day.

Fig. 1—View of Research Residence in Urbana, Ill.

Research Residence and Cooling Equipment

The Research Residence, shown in Fig. 1, together with the forced-air heating system has been described in a previous paper.[4] For the purpose of this investigation the Residence was equipped with awnings at all east, south, and west windows, and the sun-room was isolated from the rest of the house by closing the doors leading into the dining room. The entire third story was regarded as an attic, and during the daytime was isolated from the rest of the house by closing the door at the head of the stairs. The attic windows, however, were opened to provide ventilation in the attic both day and night. With the exception of the space above the northwest bedroom and the small spaces adjacent to the dormer windows, the third story had hardwood floors laid on pine sub-flooring. The small spaces adjacent to the dormer windows had no floors. In the space above the northwest bedroom 1 in. of insulating blanket was nailed to the upper edges of the floor joists. Hence. approximately all second floor ceilings were at least equivalent to lath and plaster with flooring above it. Practically no cooking was done in the kitchen, but the heat transmitted through the glass doors from the sun-room, which was not ventilated by opening the windows, compensated for this to a certain extent. Unless otherwise specified, the state of the Residence was the same for the work done during the four summers.

The arrangement of the forced-air duct system and fan is shown in Fig. 2. For the purpose of this investigation, all return ducts with the exception of the central one containing the cooling coil were blocked. The delivery ducts to the sun-room and third story were blocked, as indicated, and the dampers in the ducts to the first and second stories were adjusted to maintain the proper balance between the amounts of cooling required on these two stories.

The arrangement of the cooling plant is shown in Fig. 3. The cooling coil consisted of 8 rows of finned

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**Research Assistant Professor, Engrg. Experiment Station, University of Illinois.
†Special Research Associate, Engrg. Experiment Station, University of Illinois.
‡Research Assistant, Engrg. Experiment Station, University of Illinois.

[1] A.S.H.V.E. Research Paper, Study of Summer Cooling in the Research Residence at the University of Illinois, by A. P. Kratz and S. Konzo, A.S.H.V.E. TRANSACTIONS, Vol. 39, 1933, p. 95.

[2] A.S.H.V.E. Research Paper, Study of Summer Cooling in the Research Residence for the Summer of 1933, by A. P. Kratz and S. Konzo, A.S.H.V.E. TRANSACTIONS, Vol. 40, 1934, p. 167.

[3] A.S.H.V.E. Research Paper, Study of Summer Cooling in the Research Residence for the Summer of 1934, by A. P. Kratz, S. Konzo, M. K. Fahnestock and E. L. Broderick, A.S.H.V.E. JOURNAL SECTION, *Heating, Piping and Air Conditioning*, January, 1935, pp. 29-40.

[4] Loc. cit. Note 1.

§Paper presented at the Joint Session of the American Society of Heating and Ventilating Engineers and National Warm Air Heating and Air Conditioning Association, 42nd Annual Meeting, Chicago, Ill. January, 1936. See A.S.H.V.E. JOURNAL SECTION of *Heating, Piping and Air Conditioning*, May, 1936.

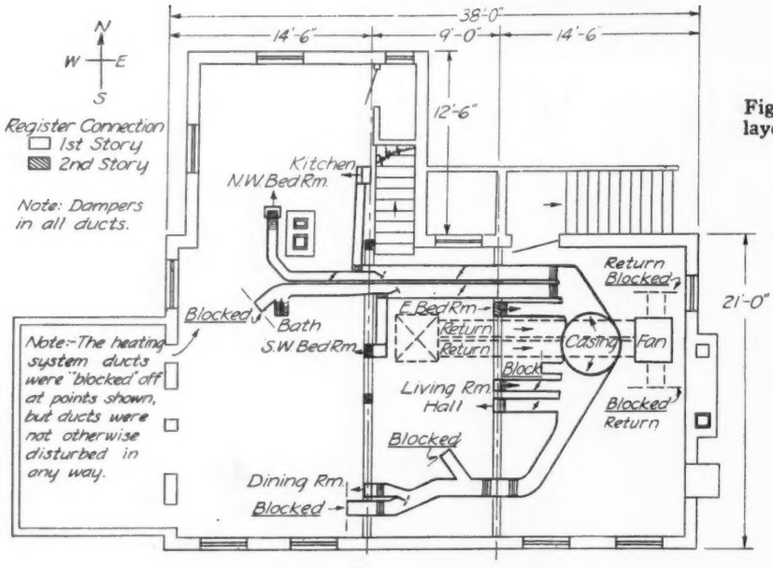


Fig. 2—Basement plan showing duct layout for forced-air system in use for distributing cool air

tubes and one row of tubes without fins. Each row consisted of 12 tubes connected into headers or return bends at the ends of the tubes. These headers were connected in such a way that the water flowed across the duct through one row of twelve tubes and returned through the next row, thus alternating through each succeeding row of tubes. The water connections were made so that the flow of the water was counter to the flow of the air, thus providing that the coldest air came in contact with the tubes containing the coldest water. The coil was arranged so that the air flowed horizontally. The water from the city service main passed through a calibrated water meter before entering the coil. As shown in Fig. 3 the tubes were grouped in sections of one, two, or three rows, and valves were provided so that different numbers of rows could be used to conform with different temperatures for the entering water. The tubes were $\frac{5}{8}$ in. outside diameter and had 8 fins per inch. The overall diameter including the fins was $1\frac{7}{16}$ in. As arranged in the duct, the gross face section of the coil was $17\frac{9}{16}$ in. high and $35\frac{1}{2}$ in. wide, giving a gross face area of 4.33 sq ft. The net face area was 3.56 sq ft. The net free area was 1.76 sq ft. The total area of cooling surface, including the row without fins was 429 sq ft, and based on a volume of air circulated of 1277 cfm the gross face velocity was 295, the net face velocity was 359 and the velocity through the net free area was 726 fpm.

Selecting the Coil

The selection of the cooling coil was based on the following considerations. Previous tests with a mechanical refrigerating unit in the Research Residence (Table 1, 1934)[5] had indicated an actual maximum cooling load of approximately 30,000 Btu per hour, of which 22,000 was sensible heat and 8,000 was latent heat load. Since, in the case of cooling with water, no additional load corresponding to the heat loss from the condensing unit and motor would be imposed, it was considered that these figures could be reduced approximately 10 per cent, and a total cooling load of 27,000 Btu per hour consisting of 20,000 Btu sensible heat and 7,000 Btu latent heat was assumed as a basis for the selection of the water coils. It was further considered desirable to operate the house under the same conditions as before with a room temperature of 80 F dry-bulb and with the air leaving the registers at approximately 70 F. Since the temperature rise in the ducts between the coil and the registers had been found to be approximately 4 F, the air was required to leave the coil at a temperature of 66 F. The admission of one air change per hour from the outdoors to serve as ventilating air raised the temperature of the air entering the coils to approximately 81 F. The probable temperature drop through the coil would therefore be 15 F. From this temperature drop and the 20,000 Btu per hour, the amount of air to be circulated was calculated as 5,560 lb. per hour or approximately 1300 cfm. The temperature of the available service water was approximately 60 F., and a rise of 10 F. in the water passing through the coil was assumed. From this rise and the total cooling load of 27,000 B.t.u. per hour, the probable water requirement was determined as 324 gal. per hour.

From the manufacturer's catalog a stock coil unit was selected such that with 1300 cu. ft. of air flowing per minute a net face velocity of 365 f.p.m. would be obtained. With this unit the water velocity was estimated as 0.556 f.p.s., and from the temperatures of the entering and leaving air and water, the logarithmic mean temperature difference was calculated as 8.26 F. Following the manufacturer's recommendation, the heat transmission was based on the sensible heat alone. The overall heat transmission coefficient of 5.60 B.t.u. per square foot per degree mean temperature difference per hour, corresponding to a water velocity of 0.556 f.p.s. and an air velocity of 365 f.p.m. was selected from the manufacturers' published data. The sensible cooling load of 20,000 B.t.u. per hour required 433 sq. ft. of coil surface and this condition was approximately satisfied by 8 rows of tubes in the type of coil used.

Operating Cycles

The operation of the cooling plant was controlled by means of a thermostat located at the 60-in. level in the hall on the second story. This thermostat was used in connection with a motor-operated, water-valve placed on the outlet side of the cooling coil to start and stop the flow of water through the coil. The valve was either open or closed and moved slowly enough to prevent any water hammer.

[5]Loc. cit. Note 3.

In order to provide for both heating in the winter and cooling in the summer, the cooling coil was installed in a by-pass in the central return duct as shown in Fig. 3. For the summer work, the duct was blocked with tightly fitting dampers at *B* and *C*, and all of the air delivered by the fan in the forced-air heating system passed through the cooling coil when the air in the house was being recirculated. For the purpose of providing outdoor air for cooling during the night, a slide damper, *E*, was placed in the by-pass on the down-stream side of the coil, and a door, *G*, was placed in the recirculating duct on the down-stream side of the slide damper. For a few of the earlier tests this door was located as shown at *F* in Fig. 3, but its use was discontinued owing to difficulties in measuring the air delivery from the fan. When outdoor air was required, the basement door and the door, *G*, in the recirculating duct were opened, and the slide damper, *E*, was closed. The fan in the forced-air system was driven by a V-belt from a ¾ h.p. motor and delivered approximately 1,300 cu. ft. of air per minute when recirculating the air in the house and 2300 c.f.m. when using outdoor air at night. Outdoor air, for the purpose of ventilating during the day, was provided by means of the duct shown as Detail *A* in Fig. 3. This duct contained a venturi section for the measurement of the volume of air delivered, and it was necessary to use a small auxiliary fan in order to deliver the equivalent of approximately one air change per hour. Wet- and dry-bulb temperatures on the air entering and leaving the cooling coil were measured by means of thermometers. Two pairs of these thermometers were placed on each side of the coil, a pair near each side of the duct. The bulbs were located about 5 in. from the sides of the duct, and at about the middle of the height of the cross section. As a check on these thermometers, two hair hygrometers were also located in the duct in cross-sections corresponding to the locations of thermometers. The temperature of the water at inlet, at outlet and at intermediate points was measured by means of thermometers as shown in Fig. 3. The locations of thermometers and thermo-couples for measuring the temperature of air at other points and the location of Pitot tubes for measuring the air quantities are also shown in this figure.

Method of Conducting Tests

During the summer continuous records were made, by means of temperature recorders, of the following air temperatures: outdoor, living room, dining room, kitchen, first, second and third story halls, east bedroom, southwest bedroom and northwest bedroom. Continuous records were also made of the temperatures of the air entering and leaving the cooling coil, the water entering and leaving the cooling coil, the outdoor air taken in for ventilation and the wet- and dry-bulb temperature of the outdoor air on the north side of the house. Other incidental air temperatures were read at regular intervals. Relative humidities both indoors and outdoors were observed by means of an aspirating psychrometer. The outdoor wet- and dry-bulb readings on this psychrometer served as a basis for correcting all outdoor wet- and dry-bulb temperatures read from the recorder charts.

During the periods of operation, observations were made of the weight of water circulated through the cooling coil, the temperature of the water entering and leaving the coil, the weight of water condensed from the air and the electrical input to the fan motor. The weight of water circulated was obtained by means of a calibrated water meter and the air quantities were obtained from traverses made with Pitot tubes at section *D* in the central return duct and at the venturi section in the ventilating air duct as shown in Fig. 3.

During all of the tests the windows on the first story remained closed. The windows in the attic, with the exception of one opposite the door at the top of the stairs, remained open. For the purpose of cooling with outdoor air at night, 11 windows on the second story were opened by raising the lower sash to the full extent.

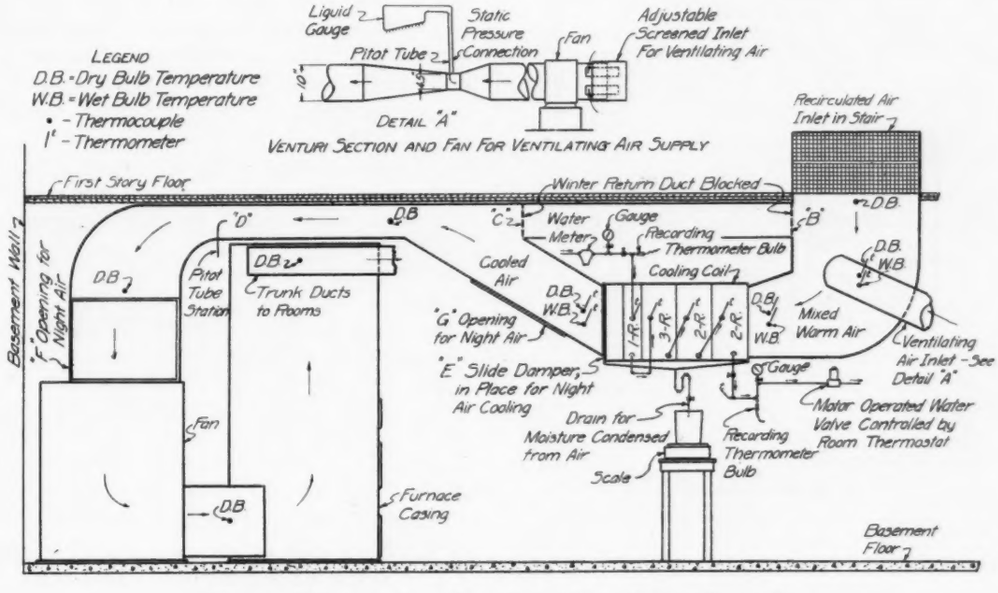


Fig. 3—Diagram of cooling plant with water cooling coil

Two windows which were opposite registers and one window at the second floor stair landing remained closed. For most of the tests the Residence was operated on the schedule as given:

The second story windows and the attic and basement doors were closed at 7 a. m. and the dampers were changed so that the fan, which had been delivering outdoor air through the system, started delivering recirculated air and the outdoor air admitted for ventilation. The former was equivalent to 4.4 recirculations of the air in the house, and the latter was equivalent to one air change per hour, making a total of 5.4 air changes per hour, delivered by the fan. The fan was allowed to run continuously during the day. When the temperature of the indoor air on the second story rose to 81 F. the motor driven valve actuated by the thermostat admitted water to the cooling coil. The cooling plant was allowed to operate with thermostatic *on* and *off* control maintaining 81 F. on the second story until the effective temperature outdoors became equal to the effective temperature on the second story indoors. The water valve was then closed the second story windows and attic door were opened and the dampers were set and the basement door opened, so that the fan delivered outdoor air through the duct system, the fan continuing to run until 7 a. m. The fan delivery was 2300 c.f.m. or 9.74 air changes per hour.

During the latter part of the season this schedule was modified by maintaining an effective temperature of approximately 74 F. instead of a dry-bulb temperature of 81 F. This was accomplished by controlling the plant manually and starting the flow of water through the coil whenever the relative humidity increased sufficiently so that with the prevailing dry-bulb temperature the effective temperature rose above 74 F.

Results of Tests

General Conditions. The operating characteristics of the cooling plant and a comparison of the actual and calculated cooling loads for the house can best be illustrated by the results obtained on a typical day. For this purpose a test made on August 2, 1935, was selected and the results are shown in Table 1 and Fig. 4. General results from all tests are given in Table 2.

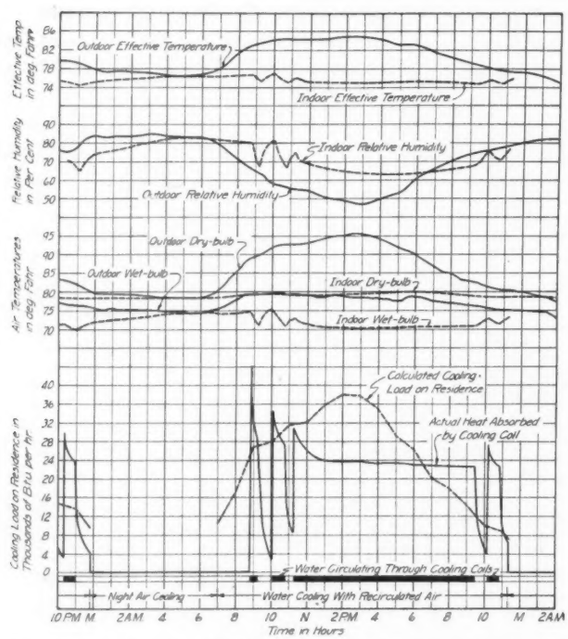


Fig. 4—Actual and calculated cooling load on residence and air temperatures, Test No. 13, Series 1-35, August 2, 1935: with night air cooling

Table 1—Typical Operating Data and Results Obtained by Cooling With Water, at 2:00 P. M. on August 2, 1935[a]

1.	Outdoor air	D.B.[b] 95.0 F., W.B. 78.6 F., D.P. 72.5 F.
	Humidity	R.H. 48.5%, S.H. 120.8 gr./lb. dry air
2.	Indoor air, aver. breathing level temperature	1st story 79.1 F., 2nd story 80.5 F.
3.	Indoor air, house aver. at breathing level	D.B. 79.8 F., W.B. 70.9 F., D.P. 67.2 F.
	Humidity	R.H. 65%, S.H. 99.8 gr./lb. dry air
4.	Indoor air, entering return grille	D.B. 77.7 F., W.B. 69.8 F., D.P. 66.2 F.
	Humidity	R.H. 67.5%, S.H. 96.8 gr./lb. dry air
5.	Ventilating air	D.B. 91.6 F., W.B. 76.2 F., D.P. 70.1 F.
	Humidity	R.H. 49.5% S.H. 111.0 gr./lb. dry air
6.	Mixed air entering cooling coil	D.B. 80.3 F., W.B. 70.7 F., D.P. 66.5 F.
	Humidity	R.H. 62.8%, S.H. 97.5 gr./lb. dry air
7.	Mixed air leaving cooling coil	D.B. 65.8 F., W.B. 64.7 F., D.P. 64.1 F.
	Humidity	R.H. 94.0%, S.H. 89.7 gr./lb. dry air
8.	Air temperature drop through cooling coil, F.	14.5
9.	Temperature of cooled air leaving registers, 1st and 2nd story aver., F.	70.2
10.	Air temperature rise in ducts and casing, F.	4.4
11.	Basement air temperature at breathing level, F.	75.2
12.	Quantity of air circulated through wet coils	1,277 c.f.m. or 5,547 lb. of dry air per hr.
	Density of air, pound, per cubic foot	0.0724
13.	No. of house air recirculations per hr.	5.4
14.	Ventilating air	238 c.f.m. or 1005 lb. of dry air per hour
	Density of air, pounds, per cubic foot	0.0704
15.	Cooling coil	gross face area 4.33 sq. ft. net free area 1.76 sq. ft.
	Surface of cooling coil, square feet.	429
	Air velocity, feet per minute	gross face 295, net face 359, free area 726
16.	Moisture condensed from air, pounds per hour	5.83
17.	Heat given up by the air; total	25,440 Btu. per hour
	Heat due to moisture in air	6,120 Btu. per hour; 24.0% of total heat absorbed
	Sensible heat	19,320 Btu. per hour; 76.0% of total heat absorbed
18.	Water temperature through cooling coil, F.	Inlet 58.3, Outlet 66.2, Rise 7.9
19.	Rise in water temperature through coil, F.	One row 0.8, Four rows 4.2, Six rows 5.5 Eight rows 7.9
20.	Water pressure at coil, pounds per square inch	Inlet 20.5. Outlet 20.0
21.	Quantity of cooling water per hour	Pounds 3000.6, Gallons 360
22.	Heat absorbed by water passing through cooling coil, Btu. per hour	23,700
23.	Recirculating fan data	Speed 477 r.p.m.
	Motor	Size ¾ h.p., Measured power rate 0.44 kw
24.	Static pressure loss through coils	Wet 0.28 in. water, Dry 0.23 in. water
25.	Total resistance of system	0.51 in. water

[a]Test number 13, series 1-35.
[b]Abbreviations used: D.B.=Dry-Bulb temperature; W.B.=Wet-Bulb temperature; D.P.=Dew Point temperature; R.H.=Relative Humidity; S.H.=Specific Humidity.

On the typical day selected, the outdoor temperature was 95.0 F. at 2 p. m. and reached a maximum of 96.0 F. at 2:30 p. m. At this time the house was being operated with a constant dry-bulb temperature of approximately 80 F., and the windows on the second story had been opened and outdoor air circulated on the previous night. The air conditions at different locations are given in the first eleven items of Table 1. The dry-bulb temperature on the second story was only 0.6 F. higher than that on the first, thus indicating a satisfactory balance of the cooling on the two stories. The temperature of the cooled air leaving the registers was approximately 70 F., and no difficulty was experienced from drafts in the rooms. The rise in temperature of the air passing through the furnace casing and ducts was 4.4 F. The quantity of air circulated was 1347 c.f.m. when the coils were dry. Increased frictional resistance when condensation was present on the coil surfaces, however, decreased this amount to 1277 c.f.m. Since part of the coil surfaces were always wet during actual operating periods, all calculations were based on 1277 c.f.m. for the volume of air circulated at the density of 0.0724 lb. per cu. ft. With this amount of air, which represented 5.4 recirculations per hour, the velocity through the net face area was 359 f.p.m. and the temperature drop through the coil was 14.5 F. This

(*Continued on page* 53)

Frost and Condensation on Windows [Part 4]

With relative humidities of a higher percentage being recommended by physicians and guaranteed by installers, frost and condensation has become an acute problem. This series of articles explains why condensation appears and suggests some methods for lessening and preventing its accumulation.

By L. W. Leonhard[1]
and J. A. Grant[1]

Predetermining Condensation Conditions

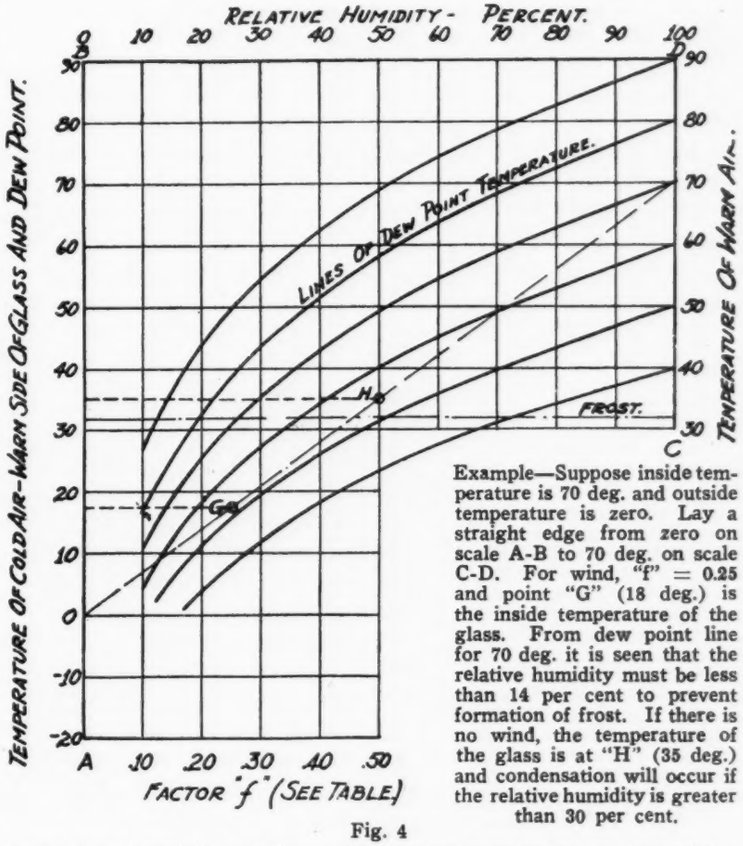
As was pointed out in the earlier part of this paper, the condition that determines whether or not condensation and frost will appear upon a window is the relation of the temperature of the inside surface of the glass to the dew-point temperature of the inside air. The glass temperature is determined by the temperature of the air inside and out, by the wind and by the conductivity of the glass. The dew-point temperature of the inside air is determined by the moisture content, or relative humidity taken in conjunction with the temperature of the air.

All of these factors are presented in the chart of Fig. 4. The temperature scale on the left applies to the cold air, the glass and the dew point; that on the right applies to the warm air. The scale of relative humidity appears at the top of the chart, and the scale for values of the factor f appears at the bottom. It will be remembered that this factor is the ratio of the number of degrees between cold and warm-air temperatures. The curved diagonal lines represent different dew-point temperatures that pass through 90 deg., 80 deg., 70 deg., 60 deg., 50 deg. and 40 deg., respectively, at 100 per cent humidity. Thus, if the warm air temperature is 60 deg., (on the righthand scale) and the relative humidity is 30 per cent (on the top scale, the dew-point temperature is 27.5 deg., as read on the left-hand scale on a horizontal line through the point of intersection of the vertical 30 per cent humidity line, and the diagonally curved dew-point line that passes through 60 deg. on the right-hand scale.

In the example indicated on the chart, the outside-air temperature is taken as 0 deg. and the warm-air temperature as 70 deg. A straight line is drawn from 0 deg. on the left-hand scale to 70 deg. on the right-hand scale. If ordinary single glazing is used, and there is a considerable wind outside, the factor f will be 0.25.

From the point where the straight line from 0 deg. to 70 deg. intersects the vertical line from $f = 0.25$, the temperature of the inside of the glass is read on the left-hand scale as 18 deg. The dew-point line through 70 deg. warm-air temperature crosses this 18 deg. line at 14 per cent relative humidity. If the relative himidity is higher than this 14 per cent, for example, say 30 per cent, the dewpoint temperature, 36 deg., is higher than the glass temperature and condensation (which will appear at once as frost because the glass temperature is below 32 deg.) will form on the colder glass surface.

(*Continued on page 70*)



Example—Suppose inside temperature is 70 deg. and outside temperature is zero. Lay a straight edge from zero on scale A-B to 70 deg. on scale C-D. For wind, "f" = 0.25 and point "G" (18 deg.) is the inside temperature of the glass. From dew point line for 70 deg. it is seen that the relative humidity must be less than 14 per cent to prevent formation of frost. If there is no wind, the temperature of the glass is at "H" (35 deg.) and condensation will occur if the relative humidity is greater than 30 per cent.

Fig. 4
Chart for determining relation of inside glass temperature to dew point and frost.

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2. *Professor of Mechanical Engineering, University of Michigan.*
3. *Chief Engineer, Detroit Steel Products Company, Detroit, Michigan.*

A Corrected Friction Chart and A Method For Sizing Ducts Directly From The Chart

The Article in the January issue of the American Artisan explaining the use of the Friction Pressure Chart for sizing duct systems has brought a number of inquiries regarding various details and several requests that a warm air trunk line system for a typical small residence be designed on this basis as a further aid to a clear understanding of the method.

By
G. A. Voorhees
Chief Engineer
Schwitzer-Cummins Co.

IN order to explain this method, let us assume that such a plant is to be laid out for the two story house shown in Fig. 1. The furnace is to be located in the corner of the basement near the chimney. All first floor registers are of the high side wall type. To cover several inquiries regarding the effect of register location on the design of such a system, it is assumed that on the second floor, registers in rooms 201 and 204 will be floor registers; room 202 will be the high side wall type and room 203 will have a wafer register just above the baseboard.

The first step is to calculate the heat requirement of each room and, having chosen the register temperature to be used as a design basis, to determine (by means of the Mechanical Warm Air Heating Code, Third Edition, or the "Direct B.t.u. method") the volume of air measured at the room air temperature of 70°, which must be supplied to heat each room.

It is presumed that those interested in this method of design are familiar with calculating the c.f.m. requirements; hence, instead of taking space to cover that phase of the problem, it will be assumed that the calculations have been made and the following requirements determined:

Room	C.F.M. Required
101	264
102	133
103	106
201	90
202	145
203	122
204	122

As explained in the preceding article, the trunk line is considered to be the continuous run of duct from the furnace bonnet to the most remote register.

The points where the various ducts terminate at the registers are designated by the first letters of the alphabet, A, B, C. etc.; and the points where the various

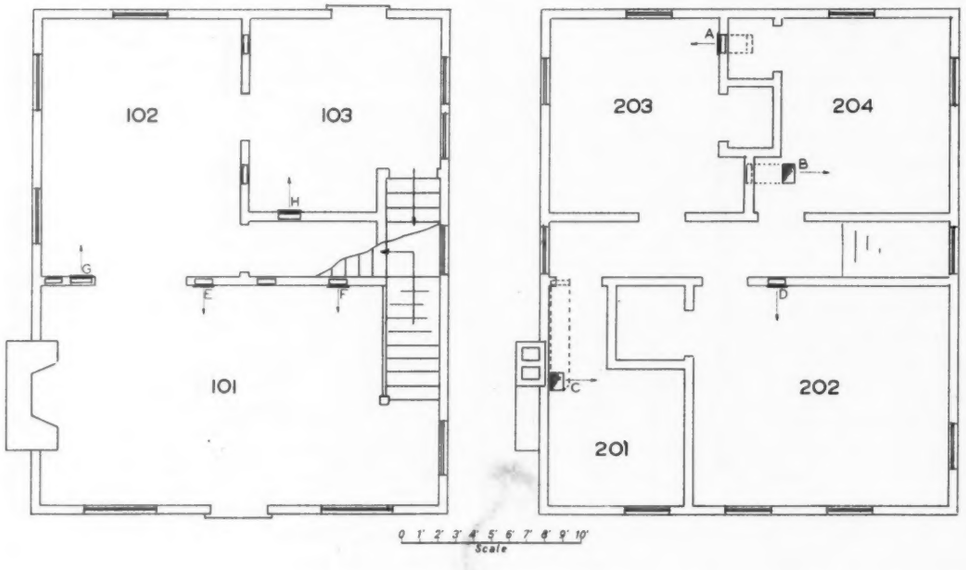

Fig. 1—First and second floor plans of problem residence showing locations of registers. See text for locations of baseboard, floor and high side wall locations.

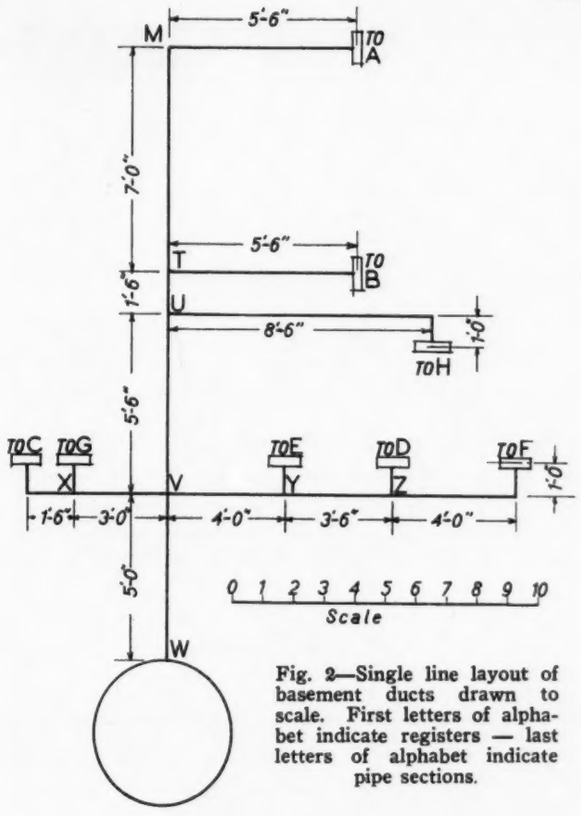

Fig. 2—Single line layout of basement ducts drawn to scale. First letters of alphabet indicate registers — last letters of alphabet indicate pipe sections.

branches join the trunk line are designated by the last letters of the alphabet, T, U, V, W, X, Y and Z. An intermediate point M is shown in Figs. 2 and 3, merely for convenience in explaining the method of determining equivalent duct lengths.

Having tabulated the c.f.m. requirements for the various rooms, the next step is to make a diagram (Fig. 2) representing the duct arrangement in the basement. Although not absolutely necessary, it is helpful if this diagram is drawn to scale to assist in determining the lengths of the duct sections. The easiest way is to indicate on the basement plan the location of risers (and first floor registers if they are of the floor or baseboard type); then lay a sheet of tracing paper over the plan and on this draw single lines to represent the ducts as in Fig. 2. Thus the basement duct lengths can be measured directly.

Assume for our present problem that the warm air supply duct system is to be designed for a "static pressure" of ⅛ inch water gauge. (It is not strictly correct to speak of the pressure loss of a duct system as "static pressure" because the *total* pressure which the blower must develop includes not only static pressure, but also velocity pressure, as is explained very clearly in S. Konzo's articles.)

Turning now to the preparation of the "Friction Pressure Chart Data Sheet" (Fig. 3) we select the most remote register (A) in room 203 and for Item I, we measure on our diagram (Fig. 2) the length of horizontal run in the basement, and add to this the number of running feet of riser including cross-overs, if any.

Fig. 4 (page 37) shows a sectional elevation of the riser to room number 203 from the elbow "M" to the register "A."

Starting from the point "W" where the supply trunk joins the furnace bonnet, we find that the distance to the elbow "M" is 19 feet. (5.0 + 5.5 + 1.5 + 7.0.) Fig. 4 shows that the horizontal distance from the elbow "M" to the riser is 5 feet and 6 inches; the vertical

ITEM	AMERICAN ARTISAN Friction Pressure Chart Data Sheet										
I	Running feet of duct from furnace to most remote register								39		
II	Additional allowance for elbows								60		
III	Total equivalent length to most remote register								99		
IV	Pressure loss (static pressure) for which duct system is to be designed								0.125		
V	Pressure loss of system per 100 feet of trunk								0.126		
VI-T-1	Trunk section	TA	UT	VU	ZD	YZ	VY	XC	WV		
VI-T-2	Running feet	27	1.5	5.5	20	3.5	4	18			
VI-T-3	Allowance for elbows	50	—	—	30	—	10	40			
VI-T-4	Total equivalent length	77	1.5	5.5	50	3.5	14	58			
VI-T-5	Pressure loss in section	0.097	0.002	0.0069	0.079	0.006	0.022	0.086			
VI-T-6	Pres. loss per 100 ft. in section	0.126	0.126	0.126	0.158	0.158	0.158	0.149	0.126		
VI-T-7	C.f.m. measured at 70°	122	244	350	145	277	409	90			
VI-T-8	C.f.m. at duct temp.	143	288	410	170	324	479	105	1150		
VI-T-9	Required round pipe diam.	6.7	8.5	10.6	6.9	8.8	10.1	5.8	14.5		
VI-T-10	Air vel. in section f.p.m.	580	680	760	660	780	850	570	990		
VI-B-1	Branch section	TB	UH	VD	ZF	YE	VC	XG	VX		
VI-B-2	Running feet	19	18	27	14	9.5	21	10	3		
VI-B-3	Allowance for elbows	40	40	40	30	30	50	30	—		
VI-B-4	Total equivalent length	59	58	67	44	40	71	40	3		
VI-B-5	Pressure loss in section	0.097	0.099	0.106	0.079	0.035	0.106	0.082	0.0045		
VI-B-6	Pres. loss per 100 ft. in section	0.164	0.17	0.158	0.179	0.213	0.149	0.215	0.149		
VI-B-7	C.f.m. measured at 70°	122	106		132	132		133	223		
VI-B-8	C.f.m. at duct temp.	143	124		154	154		156	261		
VI-B-9	Required round pipe diam.	6.4	6.0		6.5	6.2		6.2	8.3		
VI-B-10	Air vel. in section f.p.m.	650	625		675	720		720	720		

Fig. 3—Suggested data sheet completely filled in and arranged just as the engineer would separate his pipe sections and size them. It is suggested that the reader check with the text to understand how the plan is laid out.

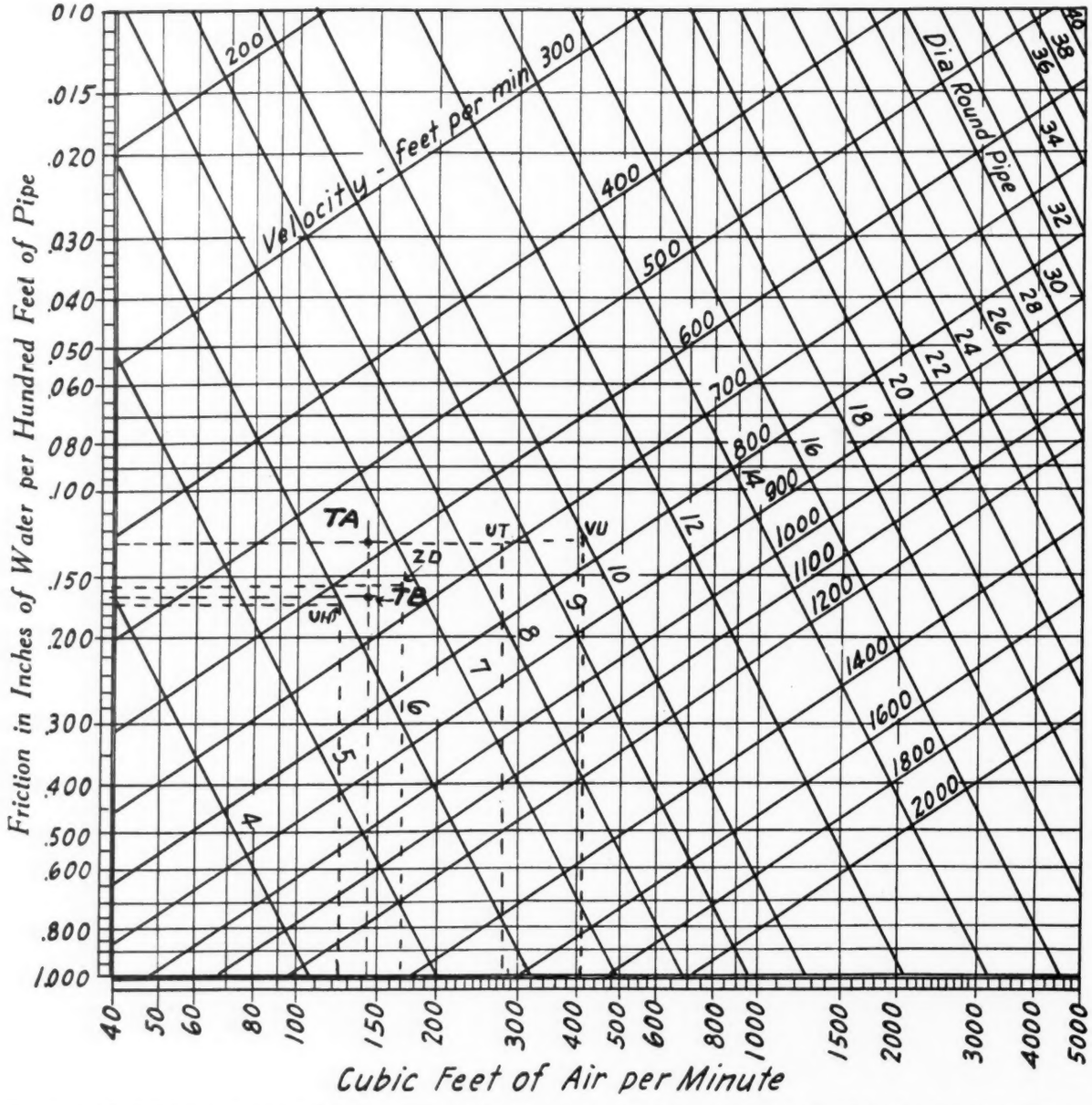

Fig. 5—Revised friction chart, originated and copyrighted by G. A. Voorhees with special provision for low c.f.m. and low pressure losses.

distance from the basement duct to the register is 12 feet and 6 inches and there is a cross-over at the second floor line of 1 foot and 6 inches making a total number of running feet from the bonnet "W" to the most remote register A as follows:

$19 + 5.5 + 12.5 + 1.5 = 38.5$ running feet.

Enter this total, 38.5 feet, or for convenience 39 feet, as Item I on the data sheet.

As explained in the previous article, it is convenient to assume that the resistance of each 90° elbow is equivalent to the resistance of 10 running feet of straight pipe. Although this "ten-foot allowance" is not exactly right, experience shows that it works out very satisfactorily on the average job and it is the method which we shall follow here in applying the friction pressure loss method.

There is one 90° turn where the air changes its direction of flow from vertical (through the furnace) to horizontal at "W." At "M" (Fig. 2 and Fig. 4) is a second 90° elbow. At the base of the riser (Fig. 4) there are two 45° angles which, together, amount to one 90° elbow. Between the first floor ceiling and the second floor, there are two 90° turns and a final 90° turn at the register A where the direction of air flow changes from vertical to horizontal. This makes a total of six 90° elbows and allowing 10 feet for each elbow we enter $6 \times 10 = 60$ as Item II on the data sheet.

The sum of Items I and II gives us Item III.

Assuming that this supply duct system is to be designed for a friction pressure loss of $\frac{1}{8}$ inch, we enter this, expressed as a decimal for convenience, as Item IV on the data sheet.

As explained in the January issue, Item V is determined as follows:

$$\text{Item V} = \frac{\text{Item IV}}{\text{Item III}} \times 100$$

$$= \frac{0.125}{99} \times 100$$

$$= 0.126$$

This is entered in the space for Item V on the data sheet.

Since the continuous run of duct from the furnace "W" to the most remote register "A" is considered as being the "trunk", that part from "T" to "A" is a "section" of the trunk.

The first column, on the data sheet will be headed (Item VI-T-1) Trunk Section T-A.

Item VI-T-2, the length in running feet of this trunk section is found by reference to Figs. 2 and 4, to be 27 feet and is so entered on the data sheet. (7.0 + 5.5 + 12.5 + 1.5 + .5.)

Figs. 2 and 4 also show five elbows (90° + [45° + 45°] + 90° + 90° + 90°) in this section and since each elbow is considered equivalent to 10 feet of pipe, we enter 50 as Item VI-T-3 for trunk section T-A.

Item VI-T-4 is Item VI-T-2 + Item VI-T-3.

The numerical value of Item VI-T-5 for Section T-A according to the rule given on page 90 of the January issue, is as follows:

$$\text{Items VI-T-5} = 0.126 \times \frac{77}{100}$$

$$= 0.097$$

Item VI-T-6 for Section T-A probably needs no explanation other than that given in the previous article.

Trunk Section T-A supplies room 203 for which 122 C.f.m. are required, measured as is customary, at the room air temperature of 70 degrees. Enter this as Item VI-T-7 for trunk section T-A.

As explained in the previous article, Item VI-T-8 for section T-A will be 1.17 × 122 = 143 C.f.m.

Referring now to the friction pressure chart (Fig. 5) locate on the scale at the left of the chart 0.126 which Item VI-T-6 shows as the friction pressure loss per hundred feet of pipe for section T-A. On the scale at the bottom of the chart, locate 143 C.f.m., the amount of air flowing in this duct as shown by Item VI-T-8. Projecting perpendicularly and to the right on the scales, we find the lines intersecting at a point which is approximately seven tenths of the distance between the inclined lines representing respectively 6-inch and 7-inch round pipe diameters. Therefore, the required round pipe diameter to enter as Item VI-T-9 for section T-A is 6.7 inches.

The location of this point of intersection between the other pair of parallel lines representing velocities of 500 F.p.m. and 600 F.p.m. respectively, shows the air velocity in the pipe to be approximately 580 F.p.m. which is entered as Item VI-T-10 for Section T-A.

Having completed the sizing of trunk section TA, we turn to branch TB which joins the trunk at "T."

Assuming that the number of running feet from T to B is found to be 19 (5.5 + 12.5 + 1), this will be entered as Item VI-B-2 for the branch section TB.

There is one elbow at T where this branch leaves the trunk, a second elbow at the foot of the stack, a third at the top of the stack and a fourth 90° turn from the cross-over to the register grille. Since there are four 90° elbows, Item VI-B-3 for Section TB will be 4 x 10 = 40.

Item VI-B-4, the total equivalent length of the section, will be the sum of Items VI-B-2 and VI-B-3 or 59 feet.

Since we must have the same frictional resistance in TB as in TA, Item VI-B-5 for section TB will be the same as Item VI-T-5 for section TA or 0.097. With a pressure loss in section TB of 0.097 and a total equivalent length of 59 feet, the pressure loss *per foot* will be 0.097 ÷ 59 = 0.00164 and the pressure loss per *hundred* feet will be 100 × 0.00164 = 0.164 which is entered as Item VI-B-6 for section TB.

Since the section TB carries 143 C.f.m., the same as section TA, we again locate 143 on the C.f.m. scale of the chart; but on the friction pressure loss scale we locate the point representing 0.164 (Item VI-B-6) and we find that the two projections intersect at a point showing a round pipe approximately 6.4 inches in diameter and a velocity of approximately 650 F.p.m. These values are entered as Items VI-B-9 and VI-B-10 respectively for branch section TB.

(*Continued on page* 58)

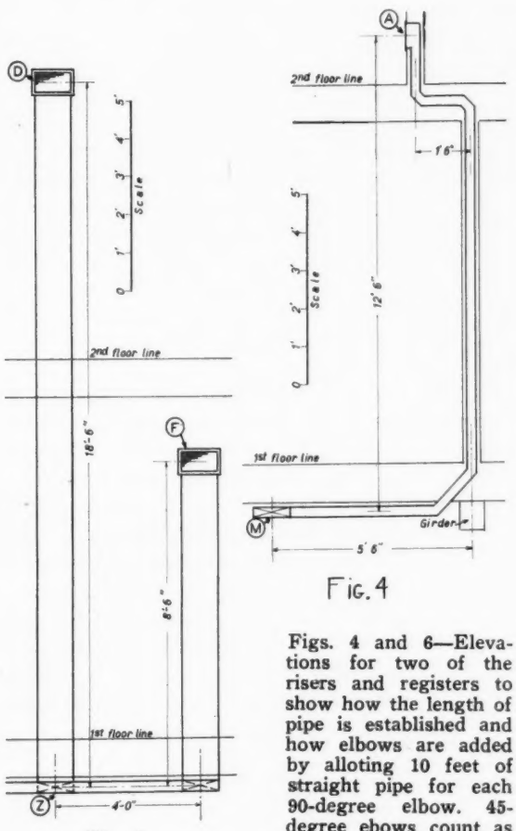

Fig. 4

Fig. 6

Figs. 4 and 6—Elevations for two of the risers and registers to show how the length of pipe is established and how elbows are added by alloting 10 feet of straight pipe for each 90-degree elbow. 45-degree ebows count as 5 feet of straight pipe.

A Rational Heat Gain Method for the Determination of Air Conditioning Cooling Loads† [Part 2]

By F. H. Faust,* L. Levine* and F. O. Urban,* Schenectady, N. Y.

Sun Effect Through Walls

The heat absorbed from solar radiation falling on exposed surfaces has already been discussed briefly. The actual process that occurs can be explained simply in connection with Fig. 4. The amount of heat received by each square foot of the wall surface depends upon the intensity of the solar heat and the angle between the surface and the rays of the sun. However, a part of this heat is reflected directly back into space without affecting the temperature of the wall surface, because all surfaces act as heat mirrors to a greater or lesser extent. The nature of the outside surface of the wall determines its effectiveness as a heat mirror, and thus is an important factor in determining how much of the incident solar heat penetrates the wall and adds to the cooling load. Of the heat absorbed by the outside surface of the wall, a portion is dissipated to the outside air and surroundings by convection and radiation and the balance is conducted through the wall into the air conditioned space.

The actual *total* amount of heat conducted through a wall exposed to the sun depends not only on the amount of solar heat which is absorbed by the outside surface but also on the overall heat transmission coefficient, and the temperatures of the indoor and outdoor air. A mathematical expression for the heat balance involved shows that the total heat conducted to the interior may, for practical purposes, be expressed by,

$$H_t = A_w\ U_w\ (t_c - t_i) + A_w R_w \qquad (3)$$

The first term of (3) is identical with (2). The second term is

$$H_r = A_w\ R_w \qquad (4)$$

where

H_r = Additional heat conducted through a wall exposed to the sun, Btu per hour

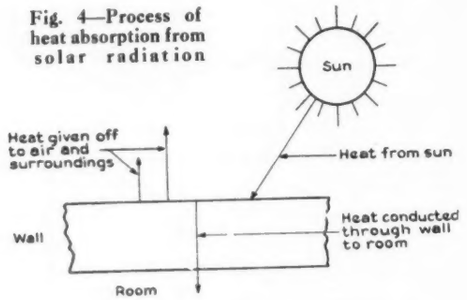

Fig. 4—Process of heat absorption from solar radiation

$$R_w = F\ a\ I \qquad (5)$$

I = Actual solar radiation striking the wall, Btu per hour per sq. ft.

a = Percentage (expressed as a decimal) of the incident solar radiation which is absorbed by the wall surface.

F = Percentage (expressed as a decimal) of the absorbed solar radiation which is transmitted to the inside.

It will be noted in (3) that the total conduction through a wall includes two additive terms. The first one is identically the same as that given above for heat conducted through a wall not exposed to the sun. The second term depends only on the intensity of the sun and the characteristics and orientation of the wall, and is independent of the temperature difference across the wall. Thus, equation (4) gives the *additional conduction* through walls exposed to the sun.

The radiation factor R_w, depends on I, the amount of solar heat incident on the wall; a, the absorption coefficient of the wall; and F, a factor which gives the percentage of the absorbed solar heat which is transmitted to the interior.

The intensity of solar radiation, I, on a given wall, depends on the amount of water vapor and dust in the atmosphere[4] through which the solar heat must travel before it reaches the surface, and the angle between the rays of the sun and the surface[5], [6]. Table 3 gives values of I for surfaces facing different directions, at different hours of the day and for several northern latitudes. These values of I take into account the average amount of water vapor and dust in the atmosphere throughout the United States, and are applicable for the period of the year during which the heat gain is normally a maximum, namely, from early May to the middle of August.

Average values of the absorption coefficient, a, are given in Table 4. The factor F depends on the overall transmission coefficient, U_w of the wall. Values of this factor are determined from the curve of Fig. 5.

It should hardly be necessary to point out here that the calculations of sun effect through walls described above are made only when the walls are definitely exposed to the sun. If the wall is shaded by trees or other buildings, there will be no heat from the sun striking it directly, and the calculation of this component of the heat gain is omitted. When the wall is only partly shaded, it will be necessary to estimate, or calculate

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†Presented at the Semi-Annual Meeting of the American Society of Heating and Ventilating Engineers, Toronto, Ont., Can., June, 1935. Published in Heating, Piping and Air Conditioning, August, 1935.

[4]The Determination of Sun Effect on Summer Cooling Loads, by Hendrickson and Walker, *Heating and Ventilating*, Vol. 30, June, 1933, p. 20.

[5]Summer Cooling for Comfort as Affected by Solar Radiation, by Hendrickson and Walker, *Heating and Ventilating*, Vol. 29, Nov. 1932, p. 14.

[6]Studies of Solar Radiation Through Bare and Shaded Windows, by Houghten, Gutberlet and Blackshaw. A.S.H.V.E. Journal, *Heating, Piping and Air Conditioning*, Vol. 6, Feb. 1934, p. 67.

Table 3—Sun Effect Coefficients at Various Latitudes for Walls Facing Several Directions

I = Btu per hour striking 1 sq. ft. of wall surface.
R_g = Btu per hour transmitted by 1 sq. ft. of single glass (for double glass multiply values of R_g given below by 0.9).

North Latitude, Degrees	Coeff.	Time of Day	Direction Wall Faces Ne	E	Se	S	Sw	W	Nw	Horizontal Surface
20	I, for walls and roofs	6 a.m.	100	105	50					15
		7	165	185	95					70
		8	175	205	115					140
		9	150	185	110					205
		10	105	135	90					260
		11	55	70	50					290
		Noon								300
		1 p.m.					50	70	55	290
		2					90	135	105	260
		3					110	185	150	205
		4					115	205	175	140
		5					95	185	165	70
		6					50	105	100	15
	R_g, for windows and skylights	6 a.m.	95	100	40					
		7	155	170	80					50
		8	155	190	95					120
		9	125	165	85					185
		10	75	110	60					235
		11	25	40	20					265
		Noon								275
		1 p.m.					20	40	25	265
		2					60	110	75	235
		3					85	165	125	185
		4					95	190	155	120
		5					80	170	155	50
		6					40	100	95	
25	I, for walls and roofs	6 a.m.	115	120	60					20
		7	165	190	105					75
		8	165	210	125					145
		9	135	185	125					210
		10	90	135	105	10				260
		11	35	70	65	25				290
		Noon			20	30	20			300
		1 p.m.				25	65	70	35	290
		2				10	105	135	90	260
		3					125	185	135	210
		4					125	210	165	145
		5					105	190	165	75
		6					60	120	115	20
	R_g, for windows and skylights	6 a.m.	105	115	45					
		7	150	175	85					55
		8	150	190	105					125
		9	110	165	100					190
		10	60	110	75					235
		11	10	40	35					265
		Noon								275
		1 p.m.					35	40	10	265
		2					75	110	60	235
		3					100	165	110	190
		4					105	190	150	125
		5					85	175	150	55
		6					45	115	105	
30	I, for walls and roofs	6 a.m.	125	135	65					25
		7	165	195	110					80
		8	160	210	135					150
		9	125	185	140	10				210
		10	75	135	120	30				255
		11	20	70	85	45				285
		Noon			35	50	35			295
		1 p.m.				45	85	70	20	285
		2				30	120	135	75	255
		3				10	140	185	125	210
		4					135	210	160	150
		5					110	195	165	80
		6					65	135	125	25
	R_g, for windows and skylights	6 a.m.	115	125	50					10
		7	150	180	95					60
		8	140	190	115					125
		9	95	165	110					190
		10	45	110	90	10				235
		11		40	55	20				260
		Noon			10	20	10			270
		1 p.m.				20	55	40		260
		2				10	90	110	45	235
		3					110	165	95	190
		4					115	190	140	125
		5					95	180	150	60
		6					50	125	115	10
35	I, for walls and roofs	6 a.m.	135	145	70					30
		7	160	200	120					85
		8	150	210	145					150
		9	110	185	150	30				205
		10	60	135	135	55				250
		11		70	100	70				280
		Noon			55	75	55			290
		1				70	100	70		280
		2				55	135	135	60	250
		3				30	150	185	110	205
		4					145	210	150	150
		5					120	200	160	85
		6					70	145	135	30
	R_g, for windows and skylights	6 a.m.	120	135	55					15
		7	145	185	100					65
		8	130	190	125					130
		9	85	165	125					185
		10	30	110	105	25				230
		11		40	70	40				255
		Noon			25	45	25			265
		1 p.m.				40	70	40		255
		2				25	105	110	30	230
		3					125	165	85	185
		4					125	190	130	130
		5					100	185	145	65
		6					55	135	120	15
40	I, for walls and roofs	6 a.m.	140	155	80					35
		7	160	200	125					90
		8	140	210	155	10				150
		9	100	185	160	45				200
		10	40	135	150	75				240
		11		70	115	95	15			270
		Noon			70	100	70			280
		1 p.m.			15	95	115	70		270
		2				75	150	135	40	240
		3				45	160	185	100	200
		4				10	155	210	140	150
		5					125	200	160	90
		6					80	155	140	35
	R_g, for windows and skylights	6 a.m.	130	140	65					20
		7	145	185	105					70
		8	120	190	135					130
		9	70	165	140	20				180
		10	15	110	125	45				220
		11		40	90	65				250
		Noon			40	70	40			255
		1 p.m.				65	90	40		250
		2				45	125	110	15	220
		3				20	140	165	70	180
		4					135	190	120	130
		5					105	185	145	70
		6					65	140	130	20
45	I, for walls and roofs	5 a.m.	70	70	25					
		6	145	165	85					40
		7	155	205	130					95
		8	130	210	165	25				145
		9	85	180	175	65				195
		10	25	135	160	95				230
		11		70	130	115	30			260
		Noon			90	125	90			265
		1 p.m.			30	115	130	70		260
		2				95	160	135	25	230
		3				65	175	180	85	195
		4				25	165	210	130	145
		5					130	205	155	95
		6					85	165	145	40
		7					25	70	70	
	R_g, for windows and skylights	5 a.m.	65	65	20					
		6	135	150	70					25
		7	140	190	115					70
		8	110	190	145					125
		9	55	165	150	35				175
		10		110	140	65				215
		11		40	105	85	10			240
		Noon			55	95	55			245
		1 p.m.			10	85	105	40		240
		2				65	140	110		215
		3				35	150	165	55	175
		4					145	190	110	125
		5					115	190	140	70
		6					70	150	135	25
		7					20	65	65	

from the geometry involved[4] what percentage of the wall is thus protected, and to make allowances accordingly.

Certain special cases arise in connection with rooms located under attics, or under flat or sloping roofs. Table 2 gives instructions for determining R_w to use in such cases. These are based on using the horizontal ceiling area to determine total sun effect through the ceiling.

The method of calculating sun effect through walls described in this paper makes possible an accurate and scientific determination of this component. Fundamentally, this method is equivalent to calculating the temperature differences across walls exposed to the sun, and avoids the necessity for estimating them. The mathematical elimination of the wall surface temperature, however, results in the simple expressions given by equations (3), (4), and (5). Furthermore, when the above method is used in conjunction with the proper combination of the several components, sun effect is included for only those walls exposed to the sun when the total cooling load is a maximum.

Table 4—Solar Absorption Coefficients (*a*) for Different Building Materials

Surfaced Material	Absorption Coefficient (*a*)
VERY LIGHT COLORED SURFACES	
Such as	
White stone	
Very light colored cement	0.4
White or light cream-colored paint	
MEDIUM DARK SURFACES	
Such as	
Asbestos shingles	
Unpainted wood	
Brown stone	0.7
Brick and red tile	
Dark-colored cement	
Stucco	
Red, green or gray paint	
VERY DARK COLORED SURFACES	
Such as	
Slate roofing	0.9
Tar roofing materials	
Very dark paints	

Sun Effect Through Windows

Transparent windows present a problem somewhat different from that of opaque walls, because they permit a large percentage of the solar energy to pass through undiminished. The actual amount of incident energy which is transmitted depends on the actual transparency of the window glass to the solar heat rays and on the angle between the rays and the surface of the glass[5], [6]. That is, the amount of heat reflected by the exterior surface of the glass depends upon the angle between the glass and the rays of the sun. An ordinary window glass which is exactly perpendicular to the rays of the sun actually permits about 90 per cent of the energy to pass through unobstructed[7], [8]. The heat gain through windows exposed to the sun is calculated by the formula:

$$H'_r = A_g R_g \qquad (6)$$

where

H'_r = solar radiation transmitted through a window, Btu per hour

A_g = Area of the glass, sq. ft.

R_g = amount of solar heat transmitted directly, through the glass, Btu. per hour per sq. ft.

[7]Surface Absorption of Heat from Solar Radiation, by Hechler and Queer, *Refrigerating Engineering*, Vol. 25, Feb. 1933, p. 86.

[8]Radiation of Energy Through Glass, by Blackshaw and Houghten, A.S.H.V.E. Journal, *Heating, Piping and Air Conditioning*, Oct. 1933, p. 523.

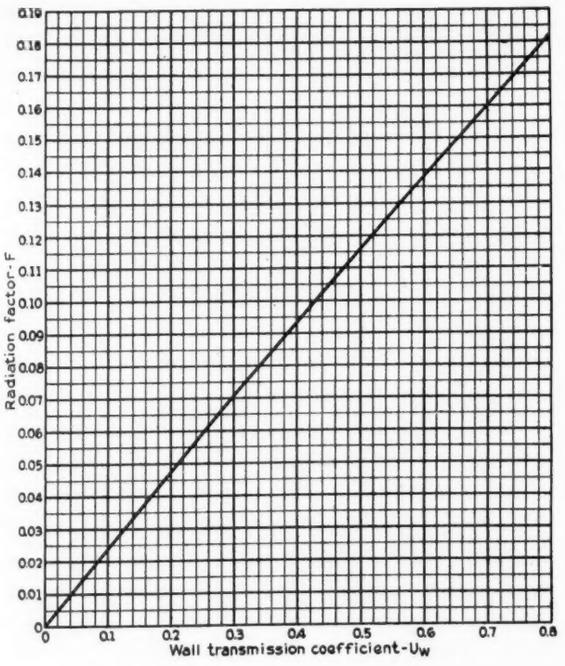

Fig. 5—Solar radiation factor vs. overall wall transmission coefficient

Values of the radiation coefficient, R_g, for windows in walls facing different directions, at different hours of the day and for several northern latitudes are given in Table 3. These values of R_g are based on the values of I given in the same table and the reflective and absorptive characteristics of ordinary window glass at various angles between the solar rays and the glass.

Recently there have been developed several special kinds of glass which are more absorptive to solar heat than ordinary window glass[9]. If the structure is glazed with windows of this character, the values of R_g given in Table 3 should be reduced in varying percentages depending on the nature of the glass used.

When windows are completely shaded from the sun by trees or other buildings, then none of the solar energy passes through them. If they are partially shaded the percentage reduction must be estimated, or calculated from the geometry involved. This is discussed by Hendrickson and Walker[4]. In the absence of such accidental shading, there are various man-made devices such as awnings, shades, and venetian blinds which may be used to mitigate the effect of the sun to a greater or lesser extent. It is somewhat difficult to give an exact appraisal of the relative effectiveness of these various devices because as yet complete experimental evidence is not available. However, the matter may be summarized about as follows[6]:

1. Devices hung *inside* the window, such as shades, or blinds, are not as effective as devices hung outside. This is because they interrupt the rays of the sun only after they have passed through the glass. Although some of the heat may be reflected back through the glass, a portion of it is absorbed and transmitted into the room.
2. Awnings are probably not so effective on the first floor of

[9]Windows—and Their Relation to Air Conditioning Problems, by W. W. Shaver, *Refrigerating Engineering*, Vol. 26, Sept. 1933, p. 133.

(*Continued on page 68*)

Forced Air Heating Facts From the Research Residence

By S. Konzo

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Rational Approach to Design of Forced-Air Heating Systems

THE art of designing forced-air heating systems for smaller installations has undergone many modifications in the past few years. The practical experience of installers and the research results from experimental homes have demonstrated that some factors were not as important as they were first believed to be. On the other hand, these observations have indicated that factors which had been neglected previously were seriously affecting the performance of the heating system. There is a growing tendency on the part of each designer to attempt to standardize the practice of designing forced-air systems and to simplify some of the steps in the process. This discussion is presented not in a sense of finality, but as an outline to a rational approach to the subject. The author has attempted a detailed analysis of the various steps in the subject, and in some cases has presented alternative methods.

General Procedure in Design

The general procedure in designing a forced-air heating system may be itemized briefly in the following manner.

1. *Heat Losses*—Determine the heat loss from each room. The heat losses may be considered as consisting of the:

a. Wall loss = Wall area in sq. ft. times wall coefficient times temperature difference between indoors and outdoors.
b. Glass loss = glass area times glass coefficient times temperature difference.
c. Ceiling loss = ceiling area times ceiling coefficient times temperature difference.
d. Floor loss = floor area times floor coefficient times temperature difference.
e. Infiltration loss = air changes in cu. ft. per hr. times 0.018.
f. The sum of the preceding losses equals the heat loss from the room, and the sum of the heat losses of the rooms equals the heat loss from the entire structure.

The method of determining heat losses is adequately covered in handbooks, the A. S. H. V. E. Guide, and codes and will not be discussed in detail at this point. However, the following items are of interest in this connection. (See Figs. 1 and 2).

a′ The indoor temperature in bathrooms and sunrooms should be maintained approximately from 5 to 10 deg. F. higher than that of the other rooms in the house.
b′ The air temperature of rooms exposed directly to the ground, such as basement recreation rooms, should also be maintained at approximately 5 deg. F. higher than the other rooms.
c′ The air infiltration in ordinary sized rooms may be determined fairly well by estimating the number of air changes per hour. The air infiltration for rooms or spaces that are very large, or that have an unusual ratio of window surface to wall surface, should be determined by determining the length of crackage, and multiplying that value by the air leakage per foot of crack.
d′ The ground temperature may be assumed as being equal to 60 deg. F.
e′ Closed spaces located between the outdoors and a heated space may be considered as having a temperature midway between the outdoors and the heated space.
f′ The temperature of garages is usually considered as approximately 40 deg. F.

2. *Register Locations*—Locate warm air supply registers and return grilles on floor plans of the structure, beginning with the upper story rooms. The subject of register locations has been covered in detail in previous articles by the author. (April, 1935; May, 1935;

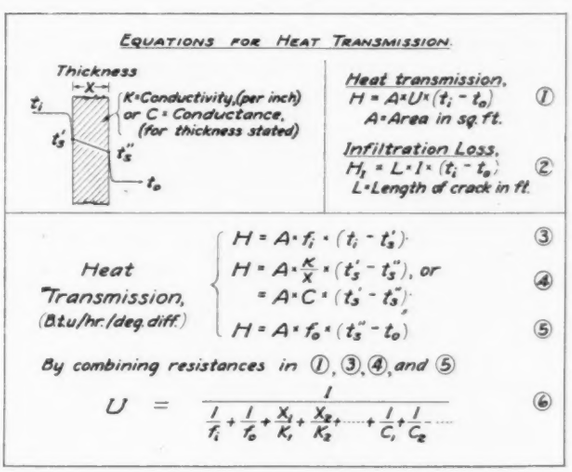

Fig. 1—(See also Fig. 2). Equations for heat transmission H = Heat loss in B.t.u. per hour; A = area in sq. ft.; V = overall coefficient of heat transfer; t_i = indoor temperature, °F; t_o = outdoor temperature, °F; t'_s = outdoor surface temperature, °F; t''_s = inside surface temperature, °F; X = thickness, in inches; K = conductivity, B.t.u. per in. per deg.; C = conductance, B.t.u. per deg.

March, 1936; May, 1936). The following items of installation should be given consideration:

a. Specify high sidewall location of register in bathrooms.
b. If registers are to be located in an exposed wall, the ducts leading to the registers should be thoroughly insulated.
c. Specify leak-proof connections at the register head to prevent streaks at the register faces.
d. Locate all registers so that there is no possibility of the warm air coming into contact with adjacent wall or ceiling surfaces.

3. Sketch of Duct Layout—Sketch in the duct layout to connect all registers and grilles with the central heating unit. A more detailed explanation of trunk duct and individual duct systems will be given in later articles. The full cooperation of the architect or builder should be secured since the layout of the duct will be influenced by the position of basement joists, the presence of other obstructions, and the desires of the home owner.

4. Equivalent Length—Determine the "equivalent length" of duct leading from the bonnet to each register. Add together the lengths of all the straight runs of pipe plus the "equivalent length" of each bend and fitting to determine which duct has the highest resistance which, in turn, determines the pipe friction we use. In ordinary practice each 90 deg. elbow, having a radius not less than 1½ times the diameter of the pipe, is usually considered as equivalent to 10 diameters length. For example, a 12-in. diameter duct that is 50 ft. in length and has three 90 deg. elbows is regarded as having an equivalent length of $50 + 3 \times 10 = 80$ ft. Elbows that have a radius less than 1½ times the diameter should be considered as having an equivalent length much greater than 10 diameters. (See April, 1936 issue)

5. Average Register Temperature Assumed—Select a value for the temperature of the air at the warm air supply registers. As a tentative estimate one may assume

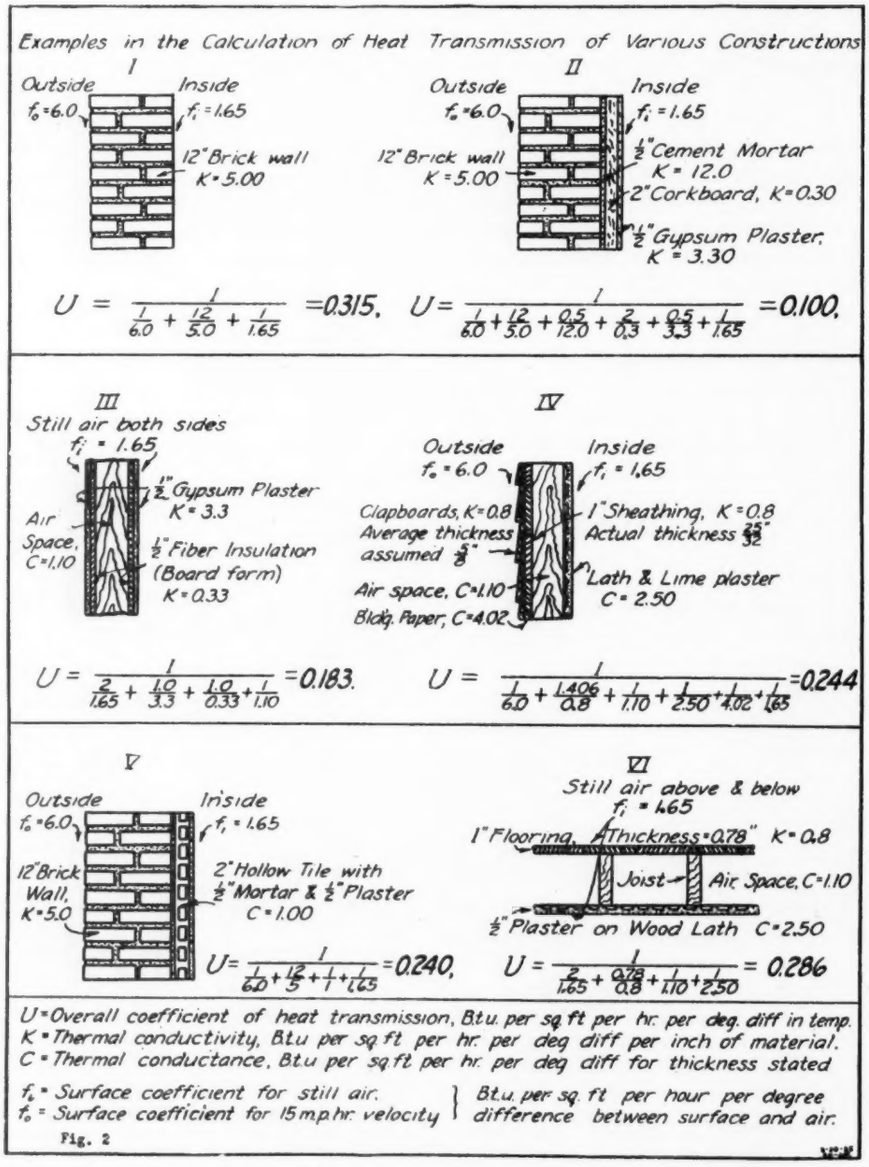

Fig. 2—Examples in the calculation of heat transmission of various constructions. (See equation 6 in Fig. 1).

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that the *average* register air temperature will be between approximately 135 deg. and 150 deg. F.

It should be noted that in some cases, particularly in well heated insulated structures, the use of register temperatures of the order of 150 deg. will be accompanied by a very small number of air recirculations. It is customary in practice to use an air circulation that will provide for approximately 5 or 6 air changes per hour. Now for any given installation the value of the *average* register temperature is directly related to the air volume being circulated. Hence it is advisable to check the air recirculations and the assumed register temperature to insure that both values are reasonable. For this purpose the author presents two calculated curves which will aid the designer in making the check.

a. Air Changes—Fig. 3 shows curves giving the air volume delivery required for any given number of air changes. The curves in Fig. 3 are a graphical representation of the equation:

$$\text{Cu. ft. per minute} = \frac{\text{No. air changes} \times \text{cu. ft. of space}}{60}$$

Example 1—Given a structure having 20,000 cu. ft. of space, assume that 6 air changes per hour is desired.

What air delivery is required?

Follow the arrows in Fig. 3 vertically on 6 until the 20,000 value is reached. The ordinate on the left hand scale indicates that 2000 c.f.m. is required.

Example 2—The curve is also useful in determining required fan capacity for night air cooling work. A structure of 16,000 cu. ft. of space is to be provided with 10 air changes per hour. The required air delivery is 2680 c.f.m.

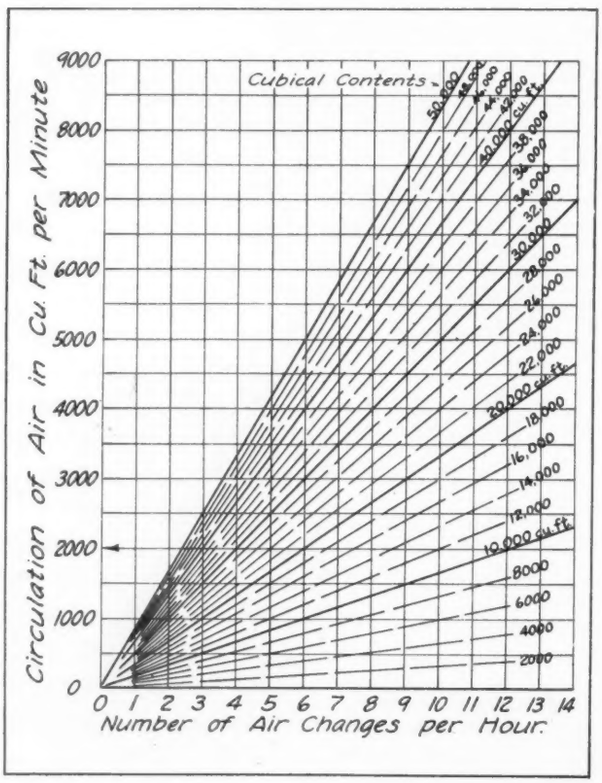


Fig. 3—Relatinship of air changes to cubic feet of air per minute. (Given: a structure having 20,000 cu. ft. Desired: 6 air changes per hr. Required: 2,000 cu. ft. of air per minute).

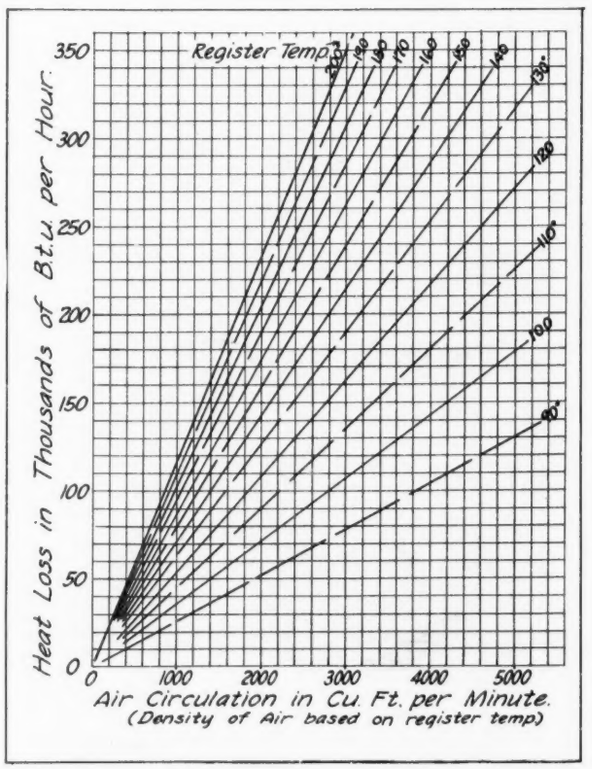


Fig. 4—Relationship between heat loss, register temperature, and cu. ft. per minute. (Given: A structure having a heat oss of 100,000 B.t.u. per hr. Desired: to circulate 2,000 cu. ft. of air per minute. Required: an average value for the register air temperature of 115 deg. F.).

b. Register Temperature—The curves in Fig. 4 show the required register temperature based on the heat loss from the structure and the air circulation. The curves in Fig. 4 are a graphical representation of the equation:

$$\text{C.f.m.} \times d\ (T_R - 65) \times 60 \times 0.24 = H \text{ where}$$

d = density at temperature of register
T_R = register supply temperatures, °F.
65 = return air temperature, °F.
H = heat loss from house, B.t.u. per hr.

Example 3—If the structure in Example 1 has a heat loss of 150,000 B.t.u. per hr. what register temperature is required?

Follow up on 2000 c.f.m. Follow across on 150,000. The intersection shows that an *average* register temperature of 145° F. is the proper value to use.

Example 4—If the same structure in Example 1 is well insulated and has a heat loss of only 100,000 B.t.u. per hr. what register temperature is required?

Follow up on 2000 c.f.m. and also across on 100,000 B.t.u. The intersection shows that an *average* register temperature of 115° is the proper value to use.

Example 5—If the structure in Example 4 with a heat loss of 100,000 B.t.u. is designed for an *average* register air temperature of 135°, what air volume delivery is required?

Follow across on 100,000 until the intersection with

(*Continued on page 66*)

View of store floor showing distribution duct and directional flow registers across the rear wall.

Air Conditioning A Drug Store

MINER & CARTER is a firm of Atlanta, Georgia druggists independently owned and operated and having one of the largest and finest stores in the southeast. In the summer of 1935 they had a floor area of 300 square feet and decided to remodel the interior of their store and at the same time to install an air conditioning system.

The contractor, Clare & Company, is a local dealer maintaining their own engineering and installation departments.

A contract was let to Clare & Company, 120 Spring St., N. W., Atlanta, to design and install a modern air conditioning system. The druggists contemplated the future addition of 1,500 square feet, so Clare & Company took this into account in the design of the system. At the time the conditioning system was installed, the duct work was designed to handle the additional space when added.

Requirements of Design

In the spring of 1936 Miner & Carter found it necessary to expand and leased the adjoining store and incorporated the additional 1,500 square feet, making a total of 4,500 square feet of floor area. Additional duct distribution lines were then installed and the machinery was then increased in size to take care of the new load.

The air conditioning system has one 15 HP reciprocating compressor connected to one 3 HP air conditioning unit. The compressor is located in the basement and space was found over a first floor toilet room for the air conditioning unit.

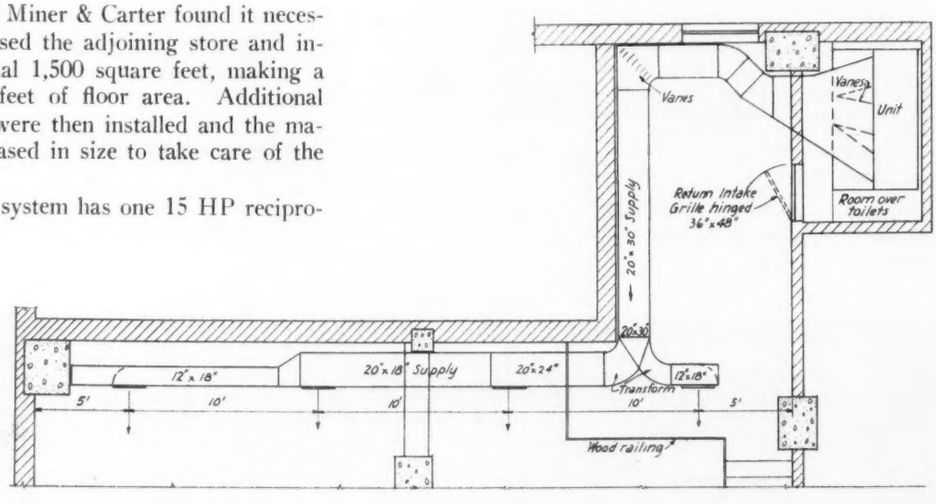
It was found impractical to install a cooling tower on the roof so an evaporative condenser was installed in the basement beside the compressor.

The air conditioning unit is of the direct expansion type, the refrigerant gas being expanded directly into a group of copper coils over which the air is passed. In passing, due to control of refrigerant temperature, the air is cooled and the correct amount of moisture is removed.

Control and Distribution

Control of conditions within the sales space is accomplished by means of a two-point thermostat located

(*Continued on page* 71)



Typical arrangement of duct work from basement blower, through conditioner above toilet, and across store.

Physical Factors Affecting Comfort*

By A. P. Kratz

Research Professor
Engineering Experiment Station
University of Illinois

Purpose of Air Conditioning

TO a considerable extent the progress of civilization has been marked by man's success in his efforts to control his natural environment. When it is considered that human life can exist through only a small range of body temperature centered around 98.6 deg. F., it is not surprising that, insofar as the more vigorous climates are concerned, man's earliest efforts to control his environment were directed towards the conservation of bodily heat.

The first attempts to accomplish this by artificial means, represented the dawn of the era of air conditioning, for air conditioning in its broadest sense is not confined to summer cooling, but constitutes the complete control of atmospheric conditions in such a manner as to produce an environment best conducive for health and comfort during both winter and summer.

The knowledge of the physiological effects of various air conditions on health is still incomplete. However, reasoning from the inference that bodily discomfort is not conducive to good health, it seems logical to conclude that the primary function of air conditioning is to provide a comfortable environment, on the assumption that such an environment is at the same time conducive to health.

Theories of Comfort

Most of the ideas regarding comfort were established in connection with the more restricted problem of heating, and were later developed to apply to both heating and cooling. In common with other arts and crafts, the practice of heating was firmly established and developed to a rather wide extent before any consideration was given to the underlying theory which was necessary for an orderly advancement in the field. The earlier theories were largely empirical, and furnished no means of explaining what constitutes comfort, or of establishing standards for evaluating or producing comfort. Since 1923, however, exhaustive studies at the Research Laboratory of the American Society of Heating and Ventilating Engineers, located at Pittsburgh, Penn., have resulted in the formulation of a theory of comfort that makes possible the establishment of standards, and affords a means of analyzing and designing both heating and cooling plants based directly on considerations relating to their effectiveness in producing comfort.

Conditions for Comfort

The modern theory of comfort is based on regarding the human body as a heat engine acting in such a manner that all bodily processes and functions ultimately result in the production of heat. The amount of heat thus generated varies with the amount of bodily activity being engaged in. For an individual seated and at rest it is approximately 400 British thermal units (hereafter referred to as B.t.u.) per hour. With a moderate degree of activity, such as walking, the heat generated is increased to between 600 and 800 B.t.u. per hour, and for various degrees of heavier work it may easily exceed 1300 to 2000 B.t.u. per hour. For each degree of activity, however, this heat must be removed at the same rate at which it is generated, or else the normal functions of the body will be interfered with, and the results may range from some degree of discomfort to permanent injury or death.

The rate of heat loss is determined by a number of factors in the environment, such as temperature, relative humidity and air motion. If the environment is not favorable to permit this loss of heat, the body attempts to compensate for it by making internal adjustments tending to accelerate or retard the loss. The most obvious of these adjustments are perspiration, shivering, and increases or decreases in skin temperature. As long as the individual is unconscious of such adjustments, a state of comfort exists. Discomfort begins as soon as the operation of the mechanism of adjustment becomes consciously apparent.

The proper function of a heating or cooling plant is, therefore, not to warm or cool the body, but to produce an environment in which the body is enabled to lose an amount of heat corresponding to that generated, without any conscious bodily adjustments having to be made.

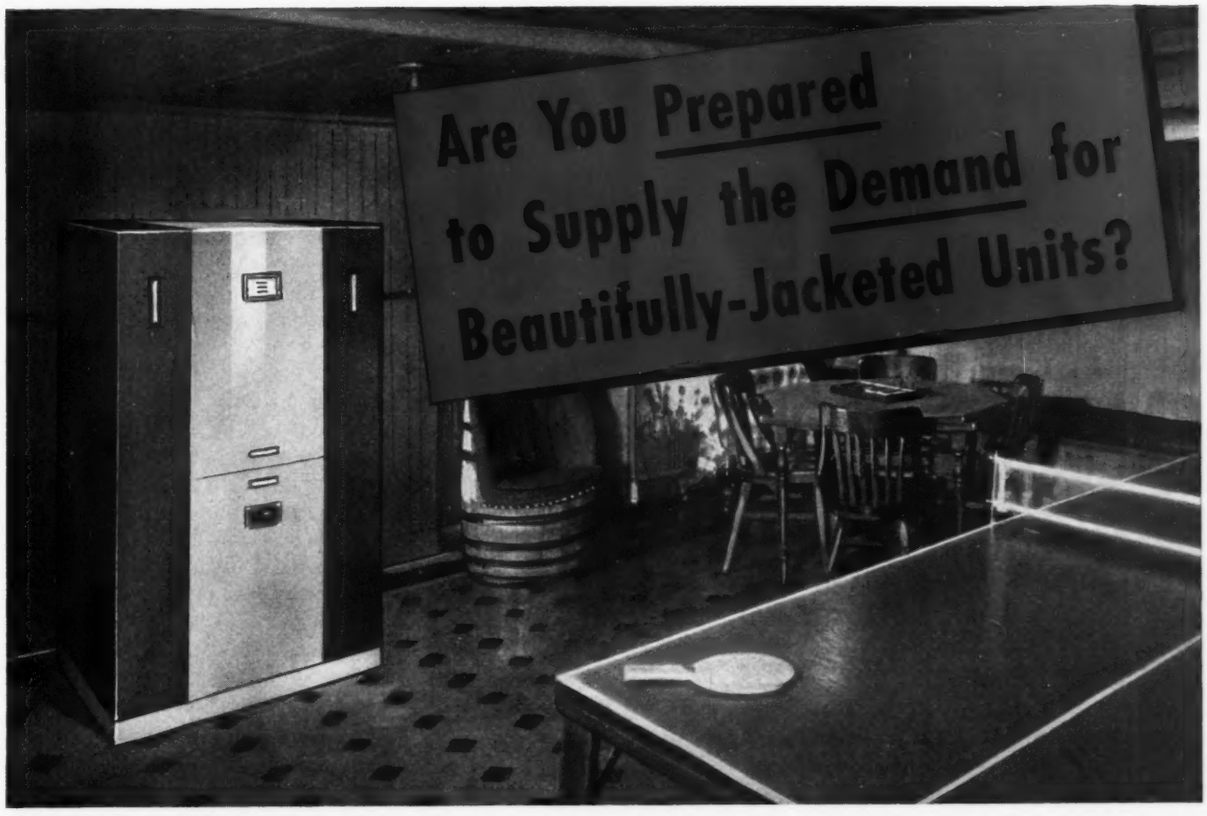
Heat Losses from the Body

Heat is lost from the body by radiation, convection, and evaporation. Radiation has properties that are similar to those of light. It is transmitted through the atmosphere without appreciably heating the air through which it passes. The amount of heat lost by radiation is dependent on the body temperature and on the temperature of nearby surfaces such as walls, furniture and steam or hot water radiators.

In the process of convection, cool air comes in contact with the body from which it absorbs heat by conduction. The air thus warmed rises and is replaced by cooler air which is in turn warmed. The amount of heat lost by convection, therefore, depends on the air temperature and the amount of air motion. Evaporation takes place from the skin and respiratory tract, and is dependent on the temperature of the air and the amount of moisture, or the relative humidity of the air. Technically, what has been designated as moisture is not present in the form of water, but rather in the form of vapor.

Under winter conditions, in a normal atmosphere at

*Paper presented at the University of Illinois Conference on Air Conditioning, Urbana, Ill., May 4 and 5, 1936.



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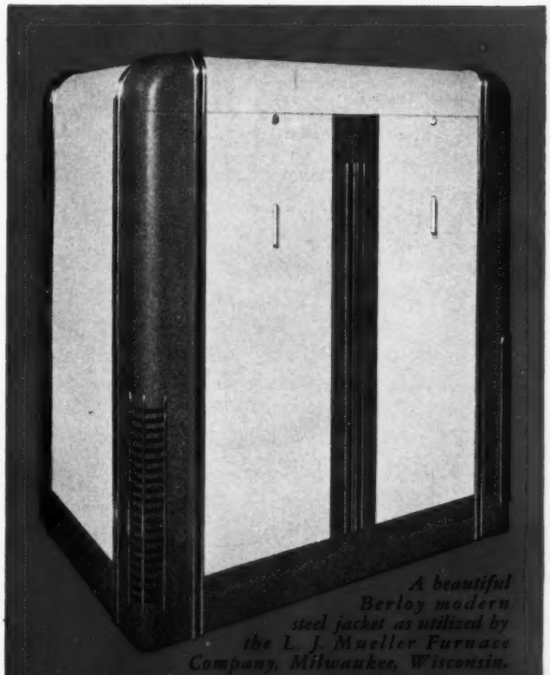

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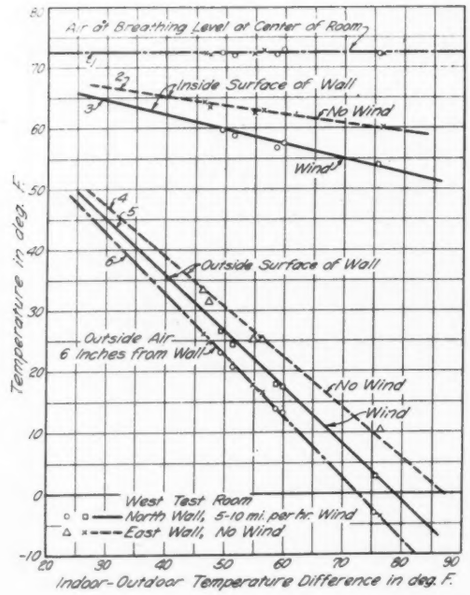

Fig. 1 — Inside and outside wall surface temperatures. (From Univ. of Ill., Eng. Exp. Sta. Bulletin No. 223, Fig. 44).

70 deg. F. and 30 per cent relative humidity, of the 400 B.t.u. per hour generated by a person seated and at rest, approximately 210 B.t.u. are lost by radiation, 90 by convection, and 100 by evaporation. These three factors, radiation, convection and evaporation, are subject to more or less independent control by varying the air temperature, air motion, and relative humidity; and by introducing warm or cold surfaces such as radiators and cold walls. However, no matter how these factors are varied, the sum of the separate heat losses must be approximately 400 B.t.u. per hour if comfort is to be maintained. The evaporation loss remains practically constant at 100 B.t.u. per hour.

Hence, the control effected by the heating plant is accomplished by so adjusting the radiation and convection losses that the sum of the two is maintained at approximately 300 B.t.u. per hour.

Fundamentally, therefore, comfort may be regarded as depending on air temperature, air motion and relative humidity, and the studies made at the Research Laboratory of the American Society of Heating and Ventilating Engineers have resulted in the establishment of a comfort chart that gives all of the various combinations of these factors which will be conducive to comfort.

Briefly, with comparatively still air, the practical range for maximum comfort under winter conditions is from 70 deg. F. with 50 per cent relative humidity to 73 deg. F. with 20 per cent relative humidity. Under summer conditions much wider variation can be tolerated, but a practical range for residence work is probably from 76 deg. F. with 70 per cent relative humidity to 82 deg. F. with 40 per cent relative humidity.

Type of Heating System and Comfort

Warm air furnace plants offer no hot surfaces in the rooms and hence the control of the heat loss from the body is accomplished almost entirely by controlling the convection. That is, if the individual feels too cold, indicating too great a heat loss, the air temperature is raised, thus reducing the loss by convection to the air. With this type of plant a temperature of 72 deg. F. with relative humidity of 30 per cent is probably most practical and satisfactory.

In the case of the conventional steam or hot water system, the radiators tend to offset part of the heat lost from the body by radiation; but the major part of the action is through the agency of convection, and in this type of plant also the air temperature must be increased when the individual tends to feel too cold. Owing to the presence of the warm radiators it is probable that an air temperature somewhat lower than that required by the warm air furnace plant will produce the same degree of comfort. Definite information on the amount of reduction permissible is lacking, however, *and it is probable that it does not exceed 2 deg. F.* The various types of convector heaters and concealed radiators produce effects lying between those of the warm air furnace and the steam or hot water radiators.

A different type of system, known as the system of radiant heating is more popular in England than in the United States. In this type of plant, low temperature panel radiators are employed. These panels cover a large portion of the walls and ceiling of the room. Very little convection occurs, and the major part of the action is through offsetting the radiant heat loss from the body. In this case, air temperatures as low as 55 deg. F. may be sufficient for comfort, and comfort is attained by raising the mean radiant temperature, or, in other words the temperature of the panel surfaces. The comfort chart is not applicable where this type of heating is used.

Effect of Cold Walls and Windows

As previously mentioned, the bodily heat loss of 300 B.t.u. per hour by combined radiation and convection is subdivided into 210 B.t.u. per hour by radiation and 90 B.t.u. per hour by convection. Hence it is evident that radiation is the more important of the two, and the temperature of the surrounding walls and objects may have a more important bearing on the comfort of the individual than is usually recognized.

The temperatures that may exist at the inside surface of a typical exposed frame wall, consisting of lath

(*Continued on page* 56)

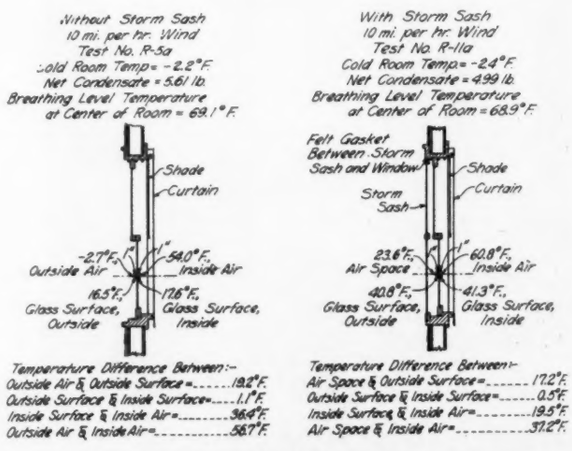

Fig. 2—Temperature gradients through glass in windows. (From Univ. of Ill., Eng. Exp. Sta. Bulletin No. 223, Fig. 45).

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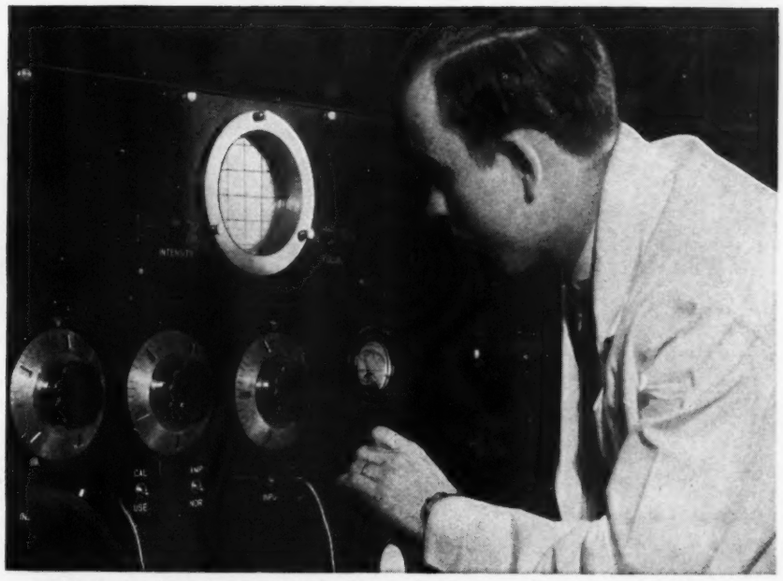

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MINNEAPOLIS HONEYWELL

Control Systems

BROWN INSTRUMENTS FOR INDICATING, RECORDING AND CONTROLLING

Research Residence Cooling

(*Continued from page 32*)

corresponded closely with the 365 f.p.m. and the 15.0 F. drop used for the selection of the coils. The free area velocity of 726 f.p.m. did not prove to be sufficient to carry any condensed moisture away from the surfaces of the cooling coil.

Cooling Load. Since the cooling coil was well lagged with corkboard to prevent heat gain, it was possible to obtain the actual cooling load either from the heat given up by the mixture of air and water vapor or from the heat absorbed by the water passing through the coil. Considerable difficulty, however, was experienced in obtaining a heat balance between these two quantities. The discrepancy was approximately 20 per cent. It was found, by making a complete traverse in the duct on

Table 2—Complete Data and Results for Tests

Date 1935	Test No.	Series No.	Weather Data: Degree-Hours Above 85 Deg	Weather Data: Degree-Hours Above 90 Deg	Sun Hour: Min	Outdoor Air: Max. Temp. During Test F	Outdoor Air: Min. Temp. Previous to Test F	Outdoor Air: Average During Period Requiring Cooling with Water, Temp. F	Outdoor Air: Average During Period Requiring Cooling with Water, Hum. %	Indoor Air Conditions: At End of Night Cooling, Temp. F	Indoor Air Conditions: Average During Period Requiring Cooling with Water, Temp. F	Indoor Air Conditions: Average During Period Requiring Cooling with Water, Hum. %	Temperature Difference: Outdoor Max. to Average Indoor F	Temperature Difference: Average Outdoor to Average Indoor F
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
July 18	2	I-35	65.20	20.56	14:45	94	67	87.8	55.6	73.0	79.3	62.7	14.7	8.5
19	3	I-35	32.00	4.64	8:20	92	70	89.4	49.3	76.0	79.8	64.5	12.2	9.6
21	4	I-35	7.84	0	11:06	87	69	82.8	76.7	73.7	78.9	70.6	8.1	3.9
22	5	I-35	2.56	0	10:10	86	73	83.9	71.5	76.1	79.4	70.2	6.6	4.5
25	6	I-35	19.36	0	12:54	89	75	87.7	64.7	77.0	79.7	67.4	9.3	8.0
26	7	I-35	11.36	0	14:32	89	70	85.5	66.0	75.7	79.8	68.0	9.2	5.7
27	8	I-35	15.92	0	12:49	88	69	83.6	71.2	75.4	78.8	68.9	9.2	4.8
28	9	I-35	36.40	3.92	11:45	92	74	86.9	80.9	76.2	79.3	70.1	12.7	7.0
30	10	I-35	60.64	16.40	14:24	94	65	88.0	68.7	73.2	79.9	67.3	14.1	8.1
31	11	I-35	71.20	22.96	12:05	95	76	88.9	68.1	79.7	79.5	66.4	15.5	9.4
Aug. 1	12	I-35	80.96	29.12	11:20	96	74	80.0	64.0	78.3	79.7	68.2	16.3	9.3
2	13	I-35	84.32	31.92	13:40	96	76	89.8	61.7	78.8	79.7	68.1	16.3	10.1
3	14	I-35	8.40	0	12:46	88	74	84.4	71.8	77.5	79.7	77.2	8.3	4.7
4	15	I-35	34.88	1.12	14:14	91	69	86.5	58.6	77.5	79.8	63.2	11.2	6.7
5	16	I-35	26.24	2.32	9:13	91	70	76.5	87.8	75.2	80.2	74.0	10.8	—3.7
6	17	I-35	65.52	19.12	14:09	94	72	87.2	71.3	75.9	79.2	69.3	14.8	8.0
7	18	I-35	1.92	0	13:21	86	76	84.6	71.6	77.9	80.0	75.1	6.0	4.6
9	19	I-35	18.00	0	12:46	88	68	81.6	79.1	73.2	80.6	71.5	7.4	1.0
10	20	I-35	14.96	0	11:05	89	70	85.7	65.1	76.2	80.1	71.2	8.9	5.6
11	21	I-35	46.88	5.44	13:59	92	70	87.4	66.6	75.5	79.8	67.1	12.2	7.6
12	22	I-35	35.04	4.40	14:26	92	72	87.2	58.4	76.4	80.3	69.0	11.7	6.9
15	23	II-35	0	0	13:30	82	68	80.6	75.5	72.7	76.1	73.3	5.9	4.5
16	24	II-35	3.20	0	13:27	87	68	83.2	70.5	73.2	76.3	81.0	10.7	6.9
18	25	II-35	2.48	0	13:04	86	68	84.1	72.6	73.9	76.5	78.7	9.5	7.6
19	26	II-35	2.80	0	8:30	86	70	84.2	72.0	74.3	76.4	83.5	9.6	7.8
20	27	II-35	1.12	0	10:56	86	70	83.3	76.8	74.5	76.7	77.6	9.3	6.6

Date 1935	Operation of the Fan: Night Air Cooling Previous to Test, Duration Hours	Night Air Cooling Previous to Test, Power Kw Hr	Recirculation Previous to Test, Duration Hours	Recirculation Previous to Test, Power Kw Hr	Recirculation During Test Period, Duration Hours	Recirculation During Test Period, Power Kw Hr	Overall Test Period (Start of Cooling with Water to Start of Night Air Cooling): Start	End	Duration Hours	Water Circulation Through Cooling Coil: Time in Hours	Quantity in Gallons	Temp. at Inlet F	Temp. Rise Through Coil F	Total Moisture Condensed Lb	Heat Absorbed by Cooling Coil During Overall Test Period, Btu: Load Due to Moisture	Sensible	Total
1	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
July 18	11.50	6.3	9.05	3.3	4.78	3.0	4:04P	8:50P	4.78	4.77	1784	57.7	6.7	15.28	16,050	83,613	99,663
19	10.17	5.4	7.45	2.8	2.55	1.1	2:27P	5:00P	2.55	2.55	860	57.7	7.6	7.88	8,280	46,212	54,492
21	9.33	5.1	7.68	3.8	4.65	1.7	4:41P	9:20P	4.65	3.15	1173	58.3	8.4	22.30	23,420	58,732	82,152
22	9.75	5.2	7.63	2.9	5.28	2.0	2:43P	8:00P	5.28	4.03	1505	58.1	8.1	30.32	31,840	69,775	101,615
25	11.92	6.0	6.62	2.6	2.88	1.3	1:37P	4:30P	2.88	2.88	1048	58.2	8.3	19.47	20,450	52,092	72,542
26	14.50	8.7	8.20	3.5	4.80	2.1	3:12P	8:00P	4.80	4.10	1476	58.3	8.2	21.92	23,030	77,830	100,860
27	11.00	6.6	6.58	2.8	7.92	3.6	1:35P	9:30P	7.92	6.32	2253	58.1	7.8	32.62	34,270	112,214	146,484
28	9.50	5.5	6.93	3.2	8.57	3.8	1:56P	10:30P	8.57	6.53	2432	58.3	8.2	47.06	49,420	116,794	166,214
30	10.50	6.2	8.68	3.8	6.32	2.8	3:41P	10:00P	6.32	4.07	1481	58.2	8.9	23.67	24,860	84,966	109,826
31	9.00	5.3	2.08	0.8	14.42	6.6	9:05A	11:30P	14.42	12.10	4266	57.5	8.9	93.14	97,850	218,634	316,484
Aug. 1	7.50	4.5	2.85	1.3	14.00	6.4	9:51A	11:51P	14.00	11.33	3997	58.2	8.2	66.06	69,350	203,874	273,224
2	7.15	4.1	1.85	0.9	14.50	6.8	8:51A	11:21P	14.50	11.93	4350	58.3	7.9	60.37	63,400	223,054	286,454
3	7.65	4.4	4.72	2.2	8.70	4.0	11:48A	8:30P	8.70	3.48	1276	58.3	9.1	10.45	10,970	85,854	96,824
4	10.50	6.3	8.25	3.7	4.25	2.0	3:15P	7:30P	4.25	3.20	1200	58.3	7.4	4.25	4,460	69,540	74,000
5	11.50	6.7	6.73	3.0	3.77	1.8	1:44P	5:30P	3.77	0.35	133	58.2	9.9	c	....	....	10,949
6	13.50	8.4	7.12	3.3	9.38	4.4	2:07P	11:30P	9.38	7.25	2711	58.5	8.3	50.78	53,350	134,230	187,580
7	7.50	4.7	3.65	1.8	7.85	3.5	10:39A	6:30P	7.85	1.80	704	58.8	8.9	c	....	....	52,243
9	12.00	7.5	11.82	5.5	2.00	1.0	6:49P	8:49P	2.00	0.38	147	58.6	9.1	c	....	....	11,160
10	10.18	6.2	8.50	4.1	4.25	1.9	3:30P	7:45P	4.25	1.82	667	58.5	8.6	c	....	....	47,816
11	11.25	7.0	6.90	3.2	7.60	3.6	1:54P	9:30P	7.60	3.92	1468	58.5	8.1	12.60	13,240	85,904	99,144
12	9.50	6.0	4.78	2.1	6.72	3.1	11:47A	6:30P	6.72	2.07	766	58.3	9.1	3.35	3,520	54,584	58,104
15	13.50	7.6	8.40	3.9	3.10	1.3	3.24P	6:30P	3.10	1.72	639	58.6	8.0	4.00	4,200	38,440	42,640
16	12.50	6.3	3.43	1.6	8.57	3.6	10:26A	7:00P	8.57	3.62	1390	58.3	8.0	11.45	12,030	80,690	92,720
18	12.25	6.0	4.58	2.0	6.17	2.7	11:50A	6:00P	6.17	3.20	1182	58.4	8.2	16.60	17,430	63,340	80,770
19	13.00	6.5	3.73	1.7	8.27	3.5	10:44A	7:00P	8.27	4.45	1651	58.3	7.9	26.23	27,570	81,134	108,704
20	12.00	5.9	6.37	2.8	8.10	3.5	1:22P	9:28P	8.10	5.22	1718	58.1	8.1	31.95	33,550	82,442	115,992

Note: Test No. 1 was omitted on account of incomplete data.

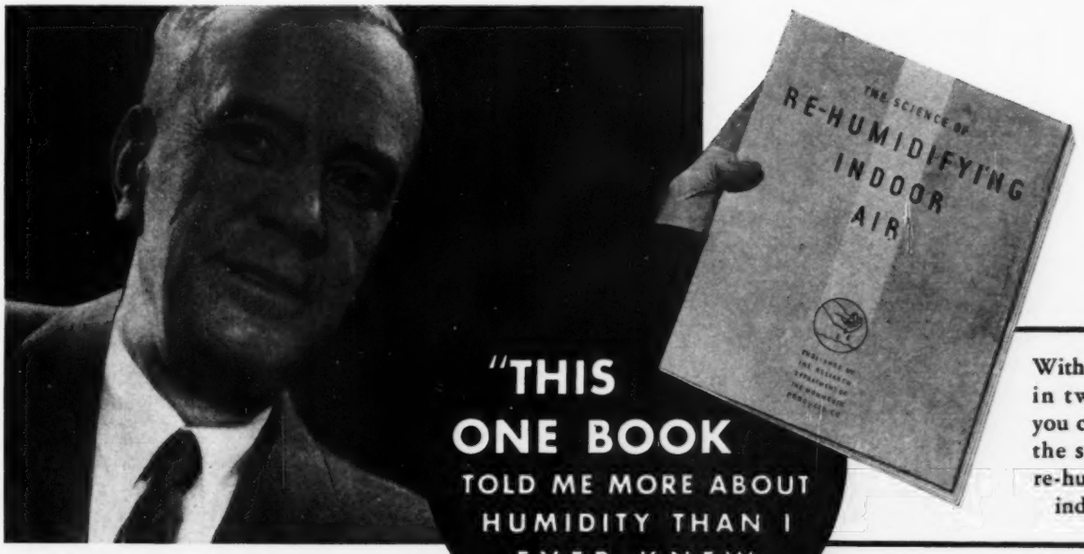
cTest too short to permit accurate determination of weight of moisture condensed.

Table 2—Complete Data and Results for Tests

both sides of the coil, that both the wet-bulb and dry-bulb temperatures varied from point to point in the cross-section of the duct. By comparing the results of these traverses with the averages of the temperatures obtained from the readings of the wet- and dry-bulb thermometers at the two reading stations on each of the upstream and downstream sides of the coil, it became evident that a correction of —0.1 had to be added to the average dry-bulb reading on the upstream side and one of +1.0 F. to that on the downstream side. Also a correction of +0.1 F. had to be added to the average wet-bulb reading on the upstream side and one of +0.5 to that on the downstream side. In addition to these corrections it was found necessary to make a correction of —0.4 F. to account for radiation received by the wet-bulb thermometers on the upstream side. No radiation correction was necessary on the downstream side, since the air was very nearly saturated and the wet-bulb temperature was practically the same as the dry-bulb temperature of the air and surrounding surfaces. By using these correct wet-bulb readings to determine the enthalpy of the moist air entering and leaving the coil it was possible to obtain a heat balance between the air and water within approximately 8 per cent. This method of calculation, however, does not show the distribution between sensible and latent heat loads. This distribution was obtained, as shown in Item 17, Table 1, by using the corrected values for the dry-bulb temperatures, and by multiplying the weighed amount of condensation from the coil by a constant representing the heat given up by the change in moisture content of the air per pound of water vapor condensed. This latter included the latent heat and superheat in the water vapor condensed, and the change in the superheat of the water vapor remaining in the air after passing the cooling coil, and amounted to 1,050 B.t.u. per pound of vapor condensed. The total of the heat given up by the air as computed by this method was within 6 per cent of the calculated heat absorbed by the water. For the purpose of analysis, and in the general results shown in Table 2, the cooling load calculated from the water circulated through the coil, as shown in Item 22, Table 1, was accepted as correct. The latent heat load was calculated from the weighed amount of moisture condensed from the air, and the sensible heat load was obtained by difference. On all tests having a duration exceeding 4 hours, the moisture load varied from 20 to 31 per cent of the total load.

It is not generally recognized that wet-bulb readings are subject to a radiation correction that can not be eliminated by any processes of shielding or increasing the velocity of the air passing over the instrument. This correction is a minimum in saturated air, where the wet-bulb depression is zero, and increases as the air becomes drier and the wet-bulb depression increases. Owing to this fact, and to point to point variations in both wet- and dry-bulb temperatures in the cross-section of a duct, it should be emphasized that heat load determinations based on the air of a system alone should be accepted with extreme caution unless some independent check on the validity of the results is available.

[Part 2 to Follow]



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Kratz Comfort Factors

(*Continued from page* 50)

and plaster, 3⅝ in. studding, sheathing and clapboards, are shown in Fig. 1. Here, when the outdoor temperature was 8 deg. F. below zero, shown as an indoor-outdoor temperature difference of 80 deg. F., the temperature of the inside surface of the exposed wall was 60 deg. F. with no wind. With a wind having a velocity of 10 m.p.h. blowing on the exposed surface, the temperature of the inside surface was only 52 deg. F. Under these conditions a slight modification must be made in the interpretation of the comfort chart. With three exposed walls and with room air at 72 deg. F., if the inside wall surfaces are at 52 deg. F. the air temperature must be increased to 78 deg. F. in order to obtain the same degree of comfort that would exist with both air and inside wall surfaces at 72 deg. F.

Naturally, the effectiveness of the wall as a heat insulator is reflected in the temperature of the inside surface. Poorly insulated walls result in low surface temperatures. The typical frame wall used for Fig. 1 had an overall heat transmission coefficient of approximately 0.26 B.t.u. per sq. ft. per hour per deg. F. If this wall had been insulated with some type of filled insulation so that the overall heat transmission coefficient was reduced from a value of 0.26 to one of 0.064, the inside surface temperature with a 15-mile per hour wind and with 8 deg. F. below zero outdoors would have been 68 deg. F. instead of 52 deg. F. In this case a room air temperature of 73 deg. F. would have produced the same degree of comfort as that obtained with both air and wall surfaces at 72 deg. F.

A very common source of discomfort arises from the presence of cold glass surfaces. Fig. 2 illustrates the inside glass surface temperatures obtained with two windows; one equipped with tightly fitting storm sash, and the other without the storm sash. In the latter case, with an outdoor temperature 2.7 deg. F. below zero the temperature of the inside surface of the glass was 17.6 deg. F. Under the same conditions in the former case the temperature of the inside surface of the inside pane of glass was 41.3 deg. F. Hence, it is evident that a few windows may be more detrimental to comfort than considerable areas of exposed wall, and that the addition of storm sash may materially increase the comfort in a room having a number of windows.

Two rather important conclusions may be drawn from the discussion in the preceding paragraphs. First, if a considerable area of cold walls and windows is present, the reading of a thermometer, ostensibly giving the temperature of the air in the room, may not afford a reliable criterion for judging the comfort of the occupants. Higher air temperatures are demanded to offset cold exposures, and in addition, a glass thermometer is less affected by radiation than is the human body. Hence a thermometer is less influenced by the presence of cold walls. Second, adequate insulation and tightly fitting storm sash, besides directly saving heat loss from the structure, have an important function in increasing inside surface temperatures, and thus directly in improv-

(*Continued on page* 72)

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Warm weather will make many sales for contractors who push the profitable BREEZ-AIR Fan this summer!

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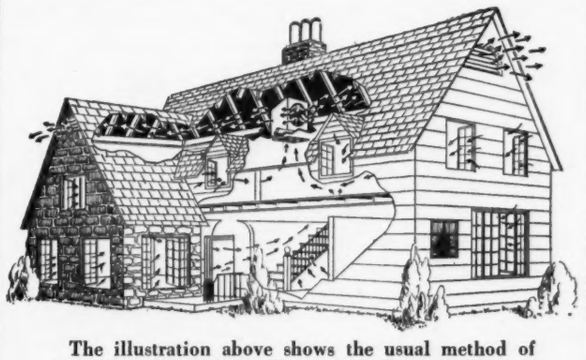

The illustration above shows the usual method of installing the Buffalo "Breez-Air" Fan. Grills and suction inlet boxes are employed. Air is discharged into the attic, suitable openings being provided so it can pass outside.

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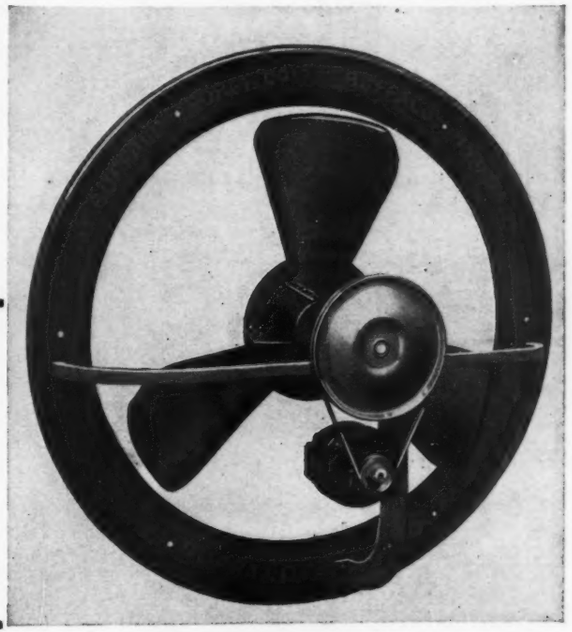

Stock Shipment on Easily-Installed, QUIET— BREEZ-AIR Fans

Voorhees Sizing Ducts

(*Continued from page 37*)

Having sized trunk section TA and branch TB, we now turn our attention to trunk section UT, which is entered as the heading of the second column (Item VI-T-1).

Items VI-T-2, 3 and 4 need no explanation.

Since UT is a part of the main trunk line which is being designed for a pressure loss of 0.126 per hundred feet, the pressure loss in this section will be:

$$\frac{0.126}{100} \times 1.5 = 0.00189$$

It is a close enough approximation to call this 0.002 and this value will be entered as Item VI-T-5 for section UT.

The air volume handled by this section will be the sum of the volumes handled by section TA and TB. $122 + 122 \times 1.17 = 285$ C.f.m. [Item VI-T-8] called 288 C.f.m. Friction chart shows 288 C.f.m. and 0.126 S.P. = point UT.

Branch UH to Room 103

The next section to be considered is the branch UH terminating in the high side wall register "H" in room 103 and it is assumed that the center line of this register will be approximately 8½ feet above the center line of the basement duct. Hence, the length of this branch in running feet will be $8.5 + 1 + 8.5 = 18$ which is entered as Item VI-B-2 for section UH.

There are four 90° elbows which include the elbow at U where the branch leaves the trunk and the final 90° turn which the air makes at the register. The allowance for elbows (Item VI-B-3) for section UH will therefore be 40.

Item VI-B-4 for section UH will be the sum of the two preceding items or 58. The pressure loss in the branch UH must be equal to the pressure loss in the main trunk line section UTMA as follows:

Pressure loss in UT = 0.002
Pressure loss in TA = 0.097

Pressure loss in UH = 0.099

This is entered as Item VI-B-5 for section UH.

Since this section is 58 feet long, the friction pressure loss *per foot* in the section will be

$$0.099 \div 58 = 0.0017$$

And for 100 feet the pressure loss will be $100 \times 0.0017 = 0.17$ which is entered as Item VI-B-6 for section UH.

Our schedule of C.f.m. requirements showed 106 C.f.m. to be supplied to room 103 and this is entered as Item VI-B-7 for section UH. Item VI-B-8 = $106 \times 1.17 = 124$ C.f.m. Friction chart for 124 C.f.m. and 0.17 shows point UH.

The next duct section to consider is trunk line section VU which designation is entered as the heading of the third column of tabulated values.

Items VI-T-2, 3 and 4 need not be explained.

Since Section VU is a part of the trunk line which is being designed for a friction pressure loss of 0.126

Harold Mueller looks over the year's advertising and sales promotion campaign which Vic Brehm, Mueller advertising manager, has prepared. Jim Shanahan, Mueller's assistant sales manager, looks on.

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per hundred feet and since the length of this section is 5.5 feet, it follows that the pressure loss in the section will be:

$$5.5 \times \frac{0.126}{100} = 0.0069$$

This is entered as Item VI-T-5 for section VU.

The C.f.m. to be entered as Item VI-T-7 is obtained by addition as follows:

Trunk Section UT,	244 C.f.m.
Branch Section UH,	106 C.f.m.
Trunk Section VU,	350 C.f.m.

Item VI-T-8 = 350 × 1.17 = 410 C.f.m. Friction chart shows 410 C.f.m. and 0.126 S.P. at point VU.

Heretofore, we have considered branches from the trunk to separate warm air supply registers. We now turn to the consideration of a branch which supplies several registers and which might therefore be called a "branch trunk."

Sizing Branch Trunk

In sizing the branch trunk which leaves the main trunk at V and supplies registers D, E and F, we proceed in the same general manner as when sizing the most remote sections of the main trunk. We first establish the pressure loss of that part of the branch trunk which has the greatest equivalent length.

From Fig. 2, it would seem that the continuous run of duct from "V" to "F" is longer, but we must keep in mind that F is a first floor, and "D" is a second floor register. Referring to Figures 2 and 6, we see that the distance from Z to F is 4 + 1 + 8.5 = 13.5 running feet. The distance from "Z" to "D" is 1 + 18.5 = 19.5 running feet.

Since each of these runs, ZF and ZD, have the same number of elbows it is evident that the equivalent length of ZD is greater than the equivalent length ZF. Hence, the most distant register in this branch trunk is register "D" in room 202.

Therefore, the section VZD is considered as the "Trunk" and the section ZF is a branch from this trunk.

The most remote section of this branch trunk is ZD which is entered on the data sheet as Item VI-T-1.

In establishing the friction pressure drop in this branch trunk, we must consider it as a branch and find what pressure loss per hundred feet will be necessary so that the total pressure loss in VZD will equal the total friction pressure loss in the main trunk section VUTA.

Hence our first step is to enter on our data sheet as Item VI-B-1 the "branch" section VD.

Figs. 2 (page—) and 6 (page —) show that the number of running feet of duct from "V" to "D" will be 4 + 3.5 + 1.0 + 18.5 = 27 which we enter as Item VI-B-2 for section VD.

There is one elbow at "V" where the branch trunk leaves the main trunk, a second at "Z" where the stub or branch runs across approximately one foot to the base of the stack, a third at the base of the riser where the air direction changes from horizontal to vertical and a fourth turn from vertical to horizontal at the register "D." Hence Item VI-B-3 for section VD will be 40.

Item VI-B-4 for section VD will be the sum of the two preceding items. (67.)

The total friction pressure loss in section VD must equal the pressure loss in the main trunk from V to A which our data sheet shows to be as follows:

Item VI-T-5 for Section TA	= 0.097
Item VI-T-5 for Section UT	= 0.002
Item VI-T-5 for Section VU	= 0.0069
Total	0.1059

Hence Item VI-B-5 or Section VD is 0.1059 which is entered on the data sheet as 0.106.

The pressure loss per hundred feet in the section will be:

$$\frac{0.106}{67} \times 100 = 0.158$$

We enter this as Item VI-B-6 for Section VD.

It is not necessary to fill in items VI-B-7 to VI-B-10 inclusive, because our purpose in tabulating the data for Section VD is to establish the friction pressure loss required in this branch trunk so as to balance the pressure loss in the main trunk.

Branch Trunk ZD

We turn now to a consideration of branch trunk section ZD which is treated on our data sheet as a "Trunk section" and we enter as a heading for the third column, Item VI-T-1, ZD.

Figures 2 and 6 show that the number of running feet of duct from "Z" to "D" and the number of elbows are respectively 19.5 and 3. These will be entered as items VI-T-2 and VI-T-3, except that the first will be entered as 20 instead of 19.5. The 3 elbows at 10 feet each equal 30 feet of pipe.

Since section ZD which we are now considering is a part of section VD and since our data sheet shows (Item VI-B-6 for section VD) that the pressure loss per hundred feet of pipe is 0.158, we'll skip item VI-T-5 for section ZD and enter 0.158 as item VI-T-6 for section ZD.

Going back now to Item VI-T-5 for Section ZB, it is evident that since the equivalent length of this section is 50 feet and the pressure loss per hundred feet is 0.158, the pressure loss in the section is:

$$\frac{0.158}{100} \times 50 = 0.079$$

Enter this as Item VI-T-5 for section ZD.

Branch ZF

Register "D" is in room 202 which requires 145 C.f.m. measured at 70° and this is entered as Item VI-T-7 for section ZD. Converted in the usual manner to C.f.m. at duct temperature, Item VI-T-8 for section ZD is 170. The friction chart for 170 C.f.m. and 0.158 shows point ZD.

The next section to consider is branch ZF and items VI-B-1 to VI-B-4 inclusive are determined in the same manner as previously explained.

Since the pressure loss in section ZF must be the same as that in section ZD so that each section will draw its required proportion of air at the junction Z,

Item VI-B-5 for section ZF is the same as item VI-T-5 for Section ZD.

(Editor's Note: It is suggested that readers work out Items VI-B-6, 7, 8, 9, 10 for ZF and check with data sheet).

Since section YZ is a part of section VD, its pressure loss *per hundred feet* of duct will also be 0.158 and hence for section YZ, Item VI-T-6 is entered before Item VI-T-5.

Item VI-T-5 for section YZ will be:

$$\frac{0.148}{100} \times 3.5 = 0.0055$$

It is sufficiently accurate to enter this on the data sheet as 0.006.

To "balance" the distribution of air at the junction Y, the pressure loss in YE must be made the same as the pressure loss in YZD. The amount of this loss is determined by adding together Items VI-T-5 for sections ZD and YZ as follows:

Item VI-T-5 for Section ZD = 0.079
Item VI-T-5 for Section YZ = 0.006

Item VI-B-5 for Section YE = 0.085

Item VI-B-2 for section YE is 9.5 running feet and Item VI-B-3 is 30 as the air makes three 90° turns in this branch. Item VI-B-4 for section YE is shown on the data sheet as 40 instead of 39.5. Accuracy is desirable in figuring heating plant requirements and tabulating the results, but it is doubtful if anything is gained by taking fractional parts of a foot into consideration in determining duct lengths when such lengths exceed 10 feet; the percentage of error involved is small.

Item VI-B-6 for section YE will be:

$$\frac{0.085}{40} \times 100 = 0.2125$$

This will be recorded as 0.213.

Register E supplies one half of the required air volume to room 101 and from our previous tabulation of C.f.m. requirement, we find that this will be 132 which is entered as Item VI-B-7 for section YE.

Since section VY is a part of the branch trunk VD its pressure loss per hundred feet (Item VI-T-6 for section VY) is 0.158 and the actual pressure loss in the section, which is 14 feet long, will be:

$$\frac{0.158}{100} \times 14 = 0.02212$$

This is entered as 0.022 in the space provided for Item VI-T-5 for section VY on the data sheet.

Item VI-T-7 for secton VY is obtained as follows:

Item VI-T-7 for section YZ = 277 C.f.m.
Item VI-B-7 for section YE = 132 C.f.m.

Item VI-T-7 for section VY = 409 C.f.m.

As explained previously the total pressure loss in the branch trunk VD was made the same as the main trunk line section VA so that the pressure loss (theoretically) would automatically cause the desired volume of air to flow from the junction V to each of these sections. In a like manner and for the same reason, the

pressure loss in the branch trunk VC must also be made equal to that in section VA.

We found that the total pressure loss in VA was 0.106 and we entered this as Item VI-B-5 for section VD. This same value (0.106) will be entered as Item VI-B-5 for section VC.

Assume that, as measured on the plans, the number of running feet of duct from V to C is 21 feet, this will be entered as Item VI-B-2 for section VC.

Since there are five 90° turns, Item VI-B-3 for section VC will be 50 and Item VI-B-4 for section VC will be 71.

The pressure loss per hundred feet in this section will be:

$$\frac{0.106}{71} \times 100 = 0.149$$

This is entered as Item VI-B-6 for section VC.

Having established the friction pressure loss per hundred feet of pipe for this branch trunk, we are now ready to size section XC. This section consists of 18 running feet of pipe and four 90° turns, from which Items VI-T-2, 3 and 4 for section XC are determined and recorded on the data sheet.

The pressure loss in this section XC will be as follows because, as previously determined the pressure loss *per hundred feet* in section VC must be 0.149:

$$58 \times \frac{0.149}{100} = 0.08642$$

Dropping the last two doubtful figures in the product, we enter Item VI-T-5 for section XC as 0.086.

The pressure loss in branch XG must be the same as that in XC which is 0.086. This is entered as Item VI-B-5 for section XG.

The pressure loss per hundred feet of pipe will be:

$$\frac{0.086}{40} \times 100 = 0.215$$

This is entered as Item VI-B-6 for section XG.

Section VX has three running feet of pipe with no elbows and its pressure loss, because it is a part of section VC must be 0.149 per hundred feet. Therefore, Item VI-B-5 for section VX will be:

$$3 \times \frac{0.0149}{100} = 0.0045$$

(A further study of the problem will show that this determination of the actual pressure loss in section VX is not necessary. For this section, the pressure loss per hundred feet has already been obtained and is used in sizing the duct. In several instances steps have been taken in the solution of this problem which are not actually necessary in a practical application of the friction pressure loss method but they have been inserted here in the belief that they would help in obtaining a clearer understanding of the principles involved.)

As an illustration, take the final section WV. The only data relative to this section which is necessary are pressure loss per hundred feet of duct and C.f.m.

Since WV is a part of the main trunk WVUTMA, its pressure loss per hundred feet of pipe is 0.126 as

(*Continued on page 70*)

Konzo Design of System

(*Continued from page* 44)

135° temperature is reached. Read downwards to obtain a value of approximately 1500 c.f.m. What number of air changes does this represent? See Fig. 3. Follow across on 1500 c.f.m. until the intersection with 20,000 cu. ft. is reached. Read downwards to obtain a value of 4.5 air changes.

It may be noted from the last three examples that for any given structure the value of the *average* register temperature is intimately related to the number of air changes that will be obtained. By increasing the assumed value of the average register air temperature the volume of air to be delivered at the registers will be decreased and hence the number of air changes will also be decreased. Conversely, by decreasing the assumed value of the average register air temperature, both the volume of air at the register and the number of air changes will be increased. The set of curves in Figs. 3 and 4 will enable a designer to make a rapid check of both values.

6. Assumed Bonnet Temperature—After having determined the *average* register air temperature to use in a given installation, the designer must estimate the bonnet air temperature that will be necessary. Three methods are available in this connection, any one of which may be used:

a. To the *average* register temperature for all the ducts add a calculated temperature drop between bonnet and register. This method is adapted particularly to extremely large installations where the lengths of ducts are well in excess of approximately 50 feet. Proper estimates of the average temperature drop are difficult to make and hence methods b and c are more often used.

b. To the *average* register temperature add an arbitrary value for the temperature drop between the bonnet and the register. In practice, a value of either 10° or 15° is used.

c. Assume a value for the efficiency of transmission of heat from the bonnet to the register. In practice a value of either 85 per cent or 90 per cent is used. In other words, a heat loss between the bonnet and register of from 15 per cent to 10 per cent is assumed.

In small and medium sized installations, methods b and c are most frequently used. In order to show the values of the bonnet temperature that will be obtained by the methods outlined in b and c, the values have been listed in Table I for various register temperatures.

TABLE I

Assumed Bonnet Air Temperatures

Register Air Temperature	Method b		Method c	
	Add 10° F.	Add 15° F.	10% duct loss	15% duct loss
Column 1	2	3	4	5
110	120	125	115	118
120	130	135	126	130
130	140	145	137	141
140	150	155	148	153
150	160	165	159	165
160	170	175	170	177
170	180	185	182	188

Note: Based on return air temperature of 65 deg. F.

In general it may be noted that the values in column 2 are not appreciably different from those in column 4. Also, the values in column 3 are not appreciably different from those in column 5. Since the method outlined under item c, columns 4 and 5, is a bit more complicated, the author is of the opinion that method b, columns 2 and 3, should be used for the design of small and medium sized duct systems.

Example 6. In example 3 for an average register temperature of 145 deg. F., what value may be assigned to the bonnet air temperature? 145 + 15 = 160 deg. F. from method b listed as column 3.

Example 7. In example 4 the register temperature (average) is 115 deg. F. The assumed value for the bonnet air temperature is 115 + 15 or 130 deg. F.

In practice, a value for the temperature drop between the bonnet temperature and the *average* register temperature of 15 deg. is commonly used. In this connection it should be noted that the *average* value of the register temperature is not to be confused with the *individual* values of the register air temperature, as will be discussed more fully in a later article. Furthermore, it should be noted that in the design of very large or long duct systems, a larger value than 15 deg. should be selected. A safer method of design in cases of this sort is to use the method embodied in item a.

This discussion of a rational approach to the design of a forced-air heating system will be continued in the succeeding article. The next step in the process is to estimate the value of the temperature of each register in the system, and from these values to calculate the required amount of air to be delivered into each room.

Editor's Note—Contractors interested in the discussion presented by Mr. Konzo and desiring to use Fig. 3 and Fig. 4 as a part of their design data may secure a larger copy of the two charts by sending a request to the editors. If sufficient requests are received the charts will be reproduced free of charge.

A Rational Heat Gain Method

(*Continued from page* 40)

a building as they are on upper floors. In the former case the surface of the ground no doubt reflects some of the solar heat through the opening under the awning, and there is secondary radiation from the warm awning itself.

3. Awnings on the first floor may be assumed to eliminate from the heat gain approximately 75 per cent of the solar radiation which would otherwise pass through the bare window, and awnings on upper floors may be assumed to exclude 85 per cent of the solar radiation from the window.
4. Inside shades, buff-colored, clean, and completely drawn may be expected to eliminate about 50 per cent of the solar radiation which would otherwise pass through the window. Dark shades are not nearly so effective.
5. Inside venetian blinds with metallic aluminum surfaces, are about as effective as inside buff shades.

Frost and Condensation

(*Continued from page 33*)

In the case of this example, frost and condensation can be prevented either by lowering the moisture content of the air, or by increasing the factor f by some means. If the moisture content is reduced so that the relative humidity becomes less than 14 per cent, no frost or condensation will appear. Or, if the value of f can be increased to 0.50 either by breaking off the wind, or by a fan on the warm side, then the temperature of the glass will rise to 35 deg. Condensation will then occur if the relative humidity is higher than 30 per cent, but the condensation will not turn to frost because the temperature of the glass is above 32 deg.

Increasing the warm-air temperature will do something towards raising the temperature of the glass. Thus, in Fig. 3, if the straight line be drawn from 0 deg. to 80 deg., it is seen that the glass temperature is increased to 20 deg. for $f = 0.25$, or to 40 deg. if $f = 0.50$.

Results of the Experiments

1. The thickness of the glass, within ordinary values, has but little effect upon the temperature of the inside surface. Both ¼-in, and ⅛-in. glass were tried. The thinner glass showed a slightly lower temperature, but not enough lower to warrant discrimination in the value. The resistance to heat transmission of the glass itself is so low, compared with that of the air films, that differences in thickness of ordinarily used glass introduces but a slight effect.

2. Circulation of air on the warm side of the window by a fan tends to nullify the effect of the wind on the cold side, and brings up the inside temperature of the glass to approximately the mean of the cold and warm air temperatures, which is the condition for no wind or forced circulation on either side.

3. Insulating the glass pane from the metal member of a steel window by a felt strip or by using a framing member of wood has no effect upon the formation of condensation or frost.

4. Double glazing, consisting of two ⅛-in. panes in contact, brought the factor f up from 0.25 to 0.35 with wind. The surfaces, although in contact, appear to offer a considerable hindrance to heat transmission.

Voorhees Sizing Ducts

(*Continued from page 64*)

shown by Item V of the data sheet, and this is entered as Item VI-T-6 for section WV.

The air volume which this duct must be designed to carry will be the sum of the following:

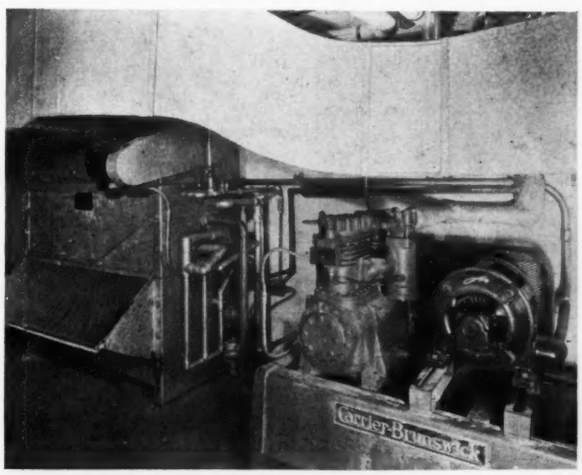
	C.f.m. at duct Temp.
Item VI-T-8 for Section VU =	410
Item VI-T-8 for Section VY =	479
Item VI-B-8 for Section VX =	261
Item VI-T-8 for Section WV =	1150

Conditioning A Drug Store

(*Continued from page 46*)

on a column. The first contact operates a solenoid valve in the refrigerant line leading to the coil closing it and allowing part of the air to be bypassed. This keeps the dry bulb temperature from going too low and at the same time maintains the proper humidity. If the load continues to drop until the second point breaks then the compressor and condenser stop.

The duct distribution system consists of a G. I. sheet metal duct extending across the rear of the building with outlets in the side blowing toward the front of the store. Ducts also extend to and deliver conditioned air to the ladies lounge and the prescription department. One large grille at the unit returns the recirculated air to the unit. An outside air duct is installed with a damper in it so that the proper amount of fresh, outside air is introduced. After the return and outside air are connected and mixed and before it enters the air conditioning unit a set of filters is installed.



The compressor and evaporative condenser which cools compressor water as a cooling tower was not possible.

The system was designed to maintain within the sales space a condition of 80° F. dry bulb and 51% relative humidity when the outside conditions did not exceed 95° dry bulb and 75° wet bulb. A total "people load" of 130 was the design condition with 1,300 c.f.m. of outside air being introduced.

The entire installation has been very satisfactory and conditions have been maintained even at times when more people were in the store than were contemplated when the system was designed.

Due to the fact that the contractor on this job is a local concern and has to live with his installation, care was taken by him to see that the job was engineered, installed and is serviced promptly and correctly. The experience of Miner & Carter on this job has been satisfactory from their standpoint and the local contractor, Clare & Company, can point to a satisfied customer and a friend.

Air Conditioning News

Invalidate Auditorium By-Pass System

The United States Circuit Court of Appeals has affirmed a decision of U. S. District Court Judge Alfred Coxe in the case of Auditorium Conditioning Corporation versus Warner Bros. Pictures, Inc., invalidating the patents owned by Auditorium on a by-pass system for air conditioning installations.

In rendering the decision, Judge Coxe said: "I think the patents must stand or fall upon the principle of using with a by-pass the recirculated or withdrawn air from the room to temper the cold, saturated air coming from the conditioner. The practice of mixing cold, conditioned air with by-passed, untreated outside air, in order to raise the temperature and reduce the relative humidity is fully disclosed in the Rietschel book, published in 1894 in the Senate report of 1895, the Hoffman British patent 1898 and the Klein patent 1919.

"It will thus be seen that there was nothing new in the use of a by-pass or in tempering cold saturated air with warmer air withdrawn from the room. The Klein patent also shows the use of dampers, automatically controlled, plus the use of a fan for mechanical circulation. I conclude, therefore, that Klein is an anticipation of both patents in the suit. The Lewis and Fleisher patents are therefore held invalid for lack of invention and the complaint is dismissed."

◆

Air-Conditioning Conference

A conference on air conditioning was held at the University of Illinois May 4 and 5, under the direction of the department of Mechanical Engineering. This conference was the first to present the technical subject of air conditioning in a non-technical manner for the purpose of presenting practical information to the average citizen. Although this idea of non-technical information was emphasized in all advanced publicity about sixty per cent of the 203 persons who registered were trained engineers. Registrations showed persons from eleven states and one foreign country.

Among the many interesting subjects covered were "What Is Air Conditioning" by President A. C. Willard; "Comfort Conditions and Physiological Factors" by F. C. Houghton, Director of Research Laboratory ASH&VE, Pittsburgh; "Physical Factors Affecting Comfort" by Prof. A. P. Kratz University of Illinois; "Essential Features of Heating System" by P. E. Mohn, Assistant Professor of Mechanical Engineering; "Factors Affecting Fuel Saving" by S. Konzo, Special Research Associate in Mechanical Engineering; "Estimating the Humidification Requirements of Residences" by W. H. Severns, Professor of Mechanical Engineering; "Air Filter in Air Conditioning Systems," by Prof. F. B. Rowley Mechanical Engineering Department, University of Minnesota. The subject of summer cooling requirements and summer cooling research were covered by Professor H. J. Macintire and Research Assistant Professor of Mechanical Engineeering M. K. Fahnestock of the University of Illinois.

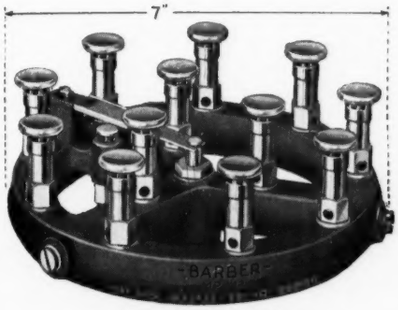
Kratz-Comfort Factors

(*Continued from page* 56)

ing comfort conditions. Furthermore, by permitting the use of lower air temperatures to attain the same degree of comfort, the use of insulation and storm sash may result in an additional indirect saving of heat.

While the preceding discussion has been made from the standpoint of heating, it is equally applicable to the case of cooling. The presence of hot walls and ceilings makes necessary the use of lower air temperatures to attain the same degree of comfort, thus imposing more load on the cooling plant.

The GAS APPLIANCE *Which Commands a Real Market Must Have a* REAL BURNER— *a* BARBER *Burner!*



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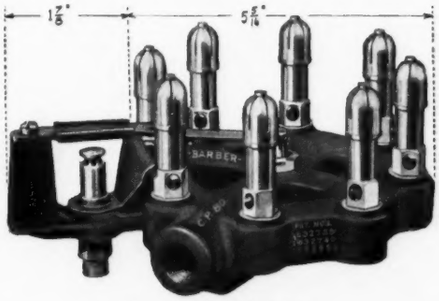

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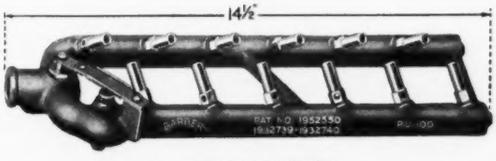

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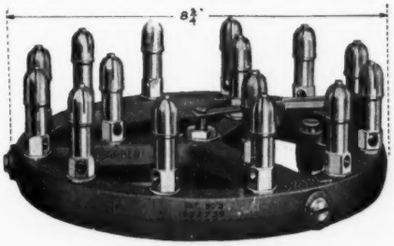

No. C. P-150 BURNER

Leading manufacturers of Gas-burning Appliances OF EVERY DESCRIPTION are now turning to Barber not only as a source of supply for reliable Burner Units—but for expert engineering advice and cooperation in the correct design of such Units. To gain public acceptance, as well as trade and engineering endorsement, it will be necessary in the future for such Appliances to use Burners meriting A. G. A. Approval.

•

The splendid performance record of Barber Conversion Burners for Water Heaters, Furnaces and Boilers, and numerous other Appliances has been known to the Trade throughout the country for over 18 years. If YOU manufacture, sell, or sponsor Gas Appliances—make use of the exceptional facilities which Barber offers for the development and perfection of YOUR PRODUCT!

•

Remember—a Gas-Burning Appliance is no better than its Burner! These illustrations represent only a very few of the NEW noiseless Barber Burner Units. If none of these Models are adaptable to YOUR PRODUCT—Barber can and will perfect one to fit the exact requirements in your case. Submit YOUR problem to Barber engineers! The service is free.

WRITE TODAY

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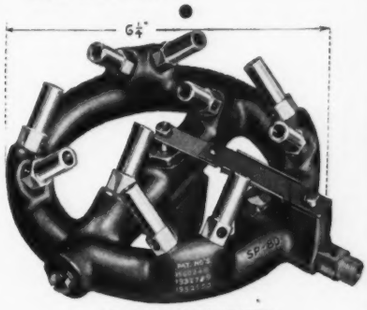
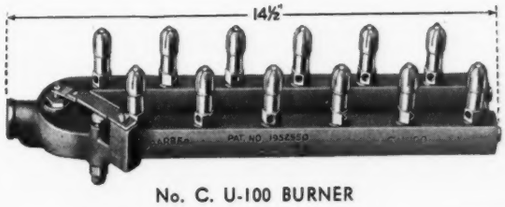


No. S. P-80 BURNER

BARBER BURNERS and Regulators are Adaptable to Such Appliances as:

Air Conditioning Equipment
High Pressure Boilers (Tubular and Tubeless)
Bakery Ovens
Doughnut Kettles
Metal Pots
Garage Heaters
Coffee Urns
Hair Dryers
Space Heaters
Floor Furnaces
Clothes Dryers
Water Heaters
Confectioners' Stoves
Vulcanizing Machines
Pressing Machine Boilers
Japanning Ovens
Core Ovens
Banana Room Heaters and many other Appliances

All Models Furnished with or without SAFETY PILOT CONTROL



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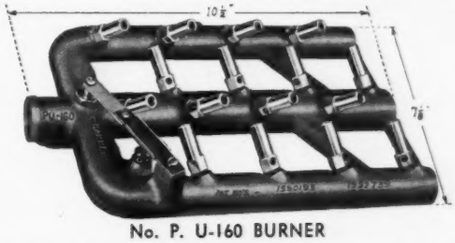


No. P. U-160 BURNER

THE BARBER GAS BURNER CO.,
3704 Superior Ave., Cleveland, Ohio

THE BARBER GAS BURNER COMPANY of MICHIGAN
4475 CASS AVE. DETROIT, MICH.

BARBER *Automatic* JET GAS BURNERS

IN THE GOOD OLD SUMMER TIME

BUSINESS AS USUAL! Welcome words? And welcome profits, too! For now you can sell heating equipment regardless of the season.

Under the Richardson Summer Volume Plan, your customers may buy R & B heating equipment now, have it installed *at once, without paying a cent until next Fall!* And then your customers begin paying for it *out of income*—only a few dollars monthly. The interest does not begin until after September 30th, and then in accordance with the Federal Housing Administration's schedule.

That should appeal to every potential customer on your list. And here are more strong selling points: All heating equipment installed by trained mechanics . . . thirty-six months in which to pay. No down payment. No red tape! Furthermore there's an additional benefit from installation of warm air apparatus during the summer. Stress the advantage of the blower unit which circulates cool air throughout the house during the hot months. That's the customer angle—and it's *good selling!*

And here's the benefit to you! The RICHARDSON SUMMER VOLUME PLAN helps you get additional business without waiting for payments. *You're free from collection and financial worries.* You get *cash in full* when the job goes in.

Perhaps in the past you have passed up financing jobs because your bank did not seem interested enough. But we *are* interested—so just send your customer's credit application right along to us. And write us for further full detailed information on how to turn the usual "summer vacation" into dollars and cents.

Don't forget—R. S. V. P.!

RICHARDSON and BOYNTON Co.

244 Madison Ave., New York City
Branch Offices in Principal Cities

The Minneapolis Heating, Ventilating and Air Conditioning Ordinance [Part 8]

Gas Burner Installation

PART XV
GAS BURNER INSTALLATIONS

Section 1501 The construction, arrangement and manner of installation of all gas burners and gas burner equipment hereafter installed for use in connection with heating systems, and the alteration and repair hereafter of all gas burners and gas burner equipment used or to be used in connection with heating systems, shall conform to the following provisions:

1501.1 Gas Burners and Gas Burner Equipment Defined: For the purpose of this ordinance, the term "gas burner" shall mean a device for the final conveyance of the gas, or a mixture of gas and air, to the combustion zone of a boiler or furnace used in connection with a heating system. The term, "gas burner equipment," shall include gas burners, as above defined, and all piping (other than supply piping from meter to appliance shut-off valve), blowers, control devices and accessories connected to the burners.

Section 1502. Approval of Gas Burners: It shall be unlawful for any person, firm, corporation or their agents, to install any gas burner, such as above defined, until an application for approval of such make or type of burner, on a form such as set forth immediately hereafter, shall have been filed with the Department of Buildings and a Certificate of Approval of such burner issued by said Department. Said Department shall issue a Certificate of Approval or Disapproval within thirty (30) days after the filing of any such application.

APPLICATION FOR
CERTIFICATE OF APPROVAL

The undersigned hereby requests that a Certificate of Approval be issued for the gas burner described below:

1. Name of Burner.....
2. Type of Burner.....
3. Name of Manufacturer.....
4. Address of Manufacturer.....
5. Kind of Fuel recommended for Burner .....
6. Length of time Burner has been on market .....
7. List approvals by States, Cities or recognized laboratories:
   Name..... Date.....
   .....
   .....
8. Attach blueprint of assembly drawing showing construction of device, indicating gas and air passages.

Application filed by.....
At Minneapolis, Minn., this.....
day of..... 193...

1502.1 The Department of Buildings shall approve any gas burner approved by the American Gas Association or any other nationally recognized inspection board or laboratory. Gas burners not approved by the American Gas Association or any other nationally recognized board or laboratory shall not be approved until they shall have been inspected and tested by the Department of Buildings. This inspection and test shall cover arrangement of parts, suitability of material, strength of parts, electrical control, thermostatic arrangement, reliability of automatic features and positiveness of ignition. In case the Department of Buildings does not feel that it is competent to make the above inspection and test, they are hereby authorized to require that the applicant submit a report of such an inspection and test from a recognized laboratory.

1502.2 With a Certificate of Disapproval the Department of Buildings shall issue to the applicant and to the manufacturer of the device a clear and concise statement as to the reason or reasons for disapproval.

1502.3 (a) New application made after the issuance of a Certificate of Disapproval shall not be made until thirty (30) days from date of issue of said certificate.

(b) New application shall be accompanied by a clear and concise statement giving reasons for reconsideration, based on information received with Certificate of Disapproval.

(c) The Department of Buildings shall act on new application as specified in Section 1502 and Sub-sections 1502.1 and 1502.2.

1502.4 When making an application to the Department of Buildings for a Certificate of Approval such as above provided for, or a reapplication for such certificate after a previous issuance of a Certificate of Disapproval of the same make or type of burner, the applicant shall be required to pay to the Inspector of Buildings, in connection with each such application or reapplication, a filing fee in the sum of Fifteen Dollars ($15.00). All such fees so collected under this ordinance shall be paid over to the City Treasurer, by the Inspector of Buildings, as soon after collection as practicable.

Section 1503 Installation of Used Gas Burners, Procedure Required: It shall hereafter be unlawful for any person, firm or corporation licensed to install, alter, repair and service gas burners within the City of Minneapolis to install any used gas burner, or for the Inspector of Buildings to issue any permit authorizing him or them so to do, until said licensee shall have first submitted, with his application for such permit, a copy of the purchase order stating that a used burner is to be installed and bearing a statement by the purchaser acknowledging that to be the case, together with a statement by said licensee that said burner has been properly reconditioned and will comply in every way with ordinance requirements for new equipment, as to operation, safety standards and adjustments.

INSPECTION AND PREPARATION OF EXISTING HEATING PLANTS BEFORE INSTALLATION OF GAS BURNERS

Section 1504. Ventilation: Gas burners, as hereinbefore defined, shall not be installed in an appliance located in a room where the normal facilities for ventilation do not permit proper combustion of the gas, unless special provision is made for supplying sufficient air for complete combustion.

Section 1505. Flues: All appliance flues through which flue gases are conducted shall be thoroughly cleaned and examined for leaks and draft conditions.

1501.1 The chimney flue and flue pipe shall be examined and reconditioned, if necessary, so that they will freely conduct the flue gases to the outer air.

1505.2 Where flue pipes are rusted or burned out, they shall be replaced by new pipe.

1505.3 Material used for flue pipe shall be such as to resist the corrosive action of flue gases.

1505.4 A draft hood or its equivalent, which is designed to (1) Insure the ready escape of the products of

(Continued on page 76)

Minneapolis Code

(*Continued from page 75*)

combustion in the event of no draft, back draft, or stoppage beyond the appliance, (2) Prevent a backdraft from entering the appliance, and (3) Neutralize the effect of stack action of the flue upon the operation of the appliance, shall be placed in and made a part of the flue pipe from the appliance, or in the appliance itself. Such device shall be subject to the approval of the Department of Buildings.

1505.5 The draft hood shall be located at a point not lower than the top of the highest flue passage in the appliance.

1505.6 Appliances of the revertible flue type shall have the draft hood located at least one foot higher than the top of the highest flue passage. In all boilers or furnaces of the revertible flue type not specifically designed for the use of gas fuel, proper provision shall be made to prevent the accumulation of gas in any part thereof.

1505.7. The internal cross-sectional area of the section of the flue pipe between the outlet of the appliance and the draft hood shall be such as to provide not less than one square inch of flue area per 7,500 hourly B. T. U. input. In no case shall this section of flue pipe be less than 3 inches in diameter and it shall not be larger than the next integral inch diameter above the size given in the following table:

MINIMUM PERMISSIBLE FLUE SIZES FOR GAS BURNER INSTALLATIONS

Input Rating B.T.U. per hour	Area of Flue Outlet—Sq. In.	Diameter of Flue Pipe—Inches
52,500	7.0	3
94,500	12.6	4
147,000	19.6	5
212,250	28.3	6
288,750	38.5	7
377,250	50.3	8
477,000	63.6	9

Based on 1 sq. in. flue area per 7,500 B. T. U. per hour input.

In cases where the outlet from the appliance is larger than the above indicated size, an orifice plate may be inserted, or a section of the flue pipe restricted to the size indicated

1505.8 The draft hood should ordinarily be located adjacent to the appliance. In cases where it appears desirable to place the draft hood at a distance from the appliance, the size of the restricted section may be modified according to the length and rise of the flue pipe.

1505.9 The proportioned section at the flue outlet of the appliance eliminates the necessity of using an adjustable damper in the flue pipe.

1505.10 Where dampers are an integral part of the boiler or furnace, they shall be removed or permanently secured in the wide open position, except such dampers the function of which is to alter the passage of flue gases through the appliances, which shall be locked in such a position as not to interfere with the normal operation of the burners.

1505.11 Flue pipe shall be relocated, where necessary, to avoid sharp turns or other constructional features which would create excessive resistance to the flow of the flue gases.

1505.12 Means shall be employed which will prevent the flue pipe from entering beyond the inner wall of the chimney flue. Flue pipe shall be cemented to the chimney wall, so as to prevent infiltration of cold air.

1505.13 No baffles shall be applied which will interfere with the proper combustion of the gas.

1505.14 Flue pipe shall be well supported to prevent sagging, shall be adequately insulated from, and in no case shall be located closer than one inch to, combustible building materials.

Section 1506. Heating Surfaces: The heating surfaces shall be thoroughly cleaned before burners are installed.

1506.1 The combustion chamber and all flue gas passages shall be gas tight.

Section 1507. Doors: When the ash pit door is closed, it is recommended that the fuel door of the heating appliance be arranged to relieve pressure due to puffs or back fire caused by delayed ignition.

News Items . . . . . .

Air Conditioning Institute

On May 21, the formal opening of the shops and laboratories of the Refrigeration and Air Conditioning Institute, 2150 Lawrence Avenue, Chicago, was celebrated with an open-house with executives and representatives of leading refrigerating and air conditioning manufacturers present to inspect the facilities offered for training future service men, engineers, salesmen and executives. Twenty-five students are at present taking shop training. The home training division has been divided into these sections: household refrigeration, commercial and industrial refrigeration, air-conditioning, general business, sales and merchandising. In the first three sections students are trained as mechanics to

service apparatus, and all the special devices now used, so that a thorough understanding of the design and operation is secured.

The air conditioning section covers the theory of conditioning and is intended to give the student a complete understanding of the methods of heating and cooling, how all the various apparatus, such as furnaces, coils, compressors, filters, etc., operate, plus information on service requirements for the apparatus used and a basic understanding of the design of most types of systems. The general business and sales and merchandising sections are intended to furnish the students with a background which will enable them to find employment in the business and sales department.

This text-book home study section of the course requires from one year to one year and a half for completion. The home-study course is followed by two weeks spent in the laboratory of the Institute during which time familiarity is gained with the apparatus used and a sufficient number of test and actual operating conditions are set up in the laboratory to enable the student to grasp the practical technical side of the industry. The Institute has prepared comprehensive information in the form of a bulletin which can be secured upon application.

◆

Death of Frank Prairie

Frank Prairie, 3522 Indiana Avenue, a pioneer in the sheet metal industry of Chicago, passed away April 29.

◆

Death of Mrs. Jack Weiner

Mrs. Jack Weiner, beloved wife of J. Weiner, proprietor of Columbia Sheet Metal Co., 728 West Lake St., Chicago, and past president of the Chicago Furnace & Sheet Metal Institute, passed away recently.

◆

George J. Meyer Dies

George J. Meyer, one of the best known heating men in the industry in the last twenty-five years, during which time he was connected with American Radiator Company, International Heater Company, L. J. Mueller Furnace Co., and the Utica Heater Company, died April 22, 1936. Mr. Meyer retired from active business a few years ago to devote his time to personal affairs.

Chicago

The Air Conditioning and Warm Air Heating Institute of Illinois is the name tentatively selected for a new association composed of warm air heating contractors doing air conditioning inside an area bounded by Waukegan on the North, Rockford and Joliet on the West, Hammond and Gary on the South, plus any contractors in a wider area interested in the organization.

The basic idea behind the organization is to secure the co-operation of a sufficient number of contractors, wholesalers and manufacturers interested in residential air conditioning to provide sufficient amounts of money to advertise over the radio three days a week and Sunday morning, fifteen minutes each period, during which broadcasts the practical advantages of air conditioning will be publicised. In addition suitable literature will be provided so that home owners answering broadcast requests will be furnished with full information on air conditioning as it exists today.

Four meetings have been held to date. Committees appointed have investigated the cost of such a program and secured numerous suggestions as to just what form the program should take. All of this information is in the hands of the tentative officers who are as follows:

President, J. H. Peterson, 20 West Hinsdale Road, Hinsdale, Illinois; 1st Vice President, J. M. Miller, Wilmette, Illinois; 2nd Vice President, W. F. H. Lahr, Danville, Illinois; secretary, Louis Drehoble, Chicago; treasurer, J. A. Miedema, Chicago.

The tentative constitution and by-laws have been adopted, subject to further amendments and final adoption. The constitution states that the purpose of the institute shall be to promote public good will toward and acceptance of the warm air heating industry and air conditioning as applied thereto. Membership shall consist of independent warm air heating contractors, manufacturers and jobbers and such other persons or representatives who are concerned with the welfare of the warm air heating industry and the independent warm air heating contractor. The following are eligible for membership in the institute: 1. warm air heating contractors, meaning any person or firm engaged in the fabrication, erection, installation or repair of warm air heating and air conditioning equipment and who is fully licensed wherever required and conforms to all codes and regulations in the community in which he practices and who can fulfil the necessary engineering and vocational requirements for membership. Manufacturers and jobbers *except* any concern which engages in erection, installation or repair of warm air heating and air conditioning equipment. To become a member, a firm or individual must pass an educational examination prepared by a membership committee, which committee shall also submit for approval a commercial credit record of the applicant, and shall determine that each applicant conforms to an accepted code of practice in his business.

The tentative affiliation fee has been set at $25.00 with an annual dues of $24. Each accepted member shall be entitled to use and to advertise in an appropriate manner the Institute's name, insignia and good will so long as he remains in good standing.

"One of the basic purposes of this association," declares tentative President Peterson, "is to establish a co-operative body of interested contractors now engaged in the warm air heating industry, aggressive enough to appreciate the advantages of co-operative advertising, willing to be judged on their engineering, technical and business ability, and anxious to co-operate to protect the established warm air heating contractors now engaged in doing air conditioning work. It is our hope that the association will furnish a means for combating those direct selling manufacturers possessing enormous financial backing which enables them to advertise and promote their products. A considerable amount of money will be needed to carry on the proposed radio advertising campaign. It is the hope of the organization that this radio broadcast will bring in sufficient prospects so that all members will be furnished with sufficient prospects close at home to more than repay the expense involved in belonging to the organization. All tentative members and officers are anxious to contact prospective members and will be glad to furnish full information upon request."

The next meeting is called for 7 p. m. July 7, South Club Room, La Salle Hotel, Chicago.

Nat'l Warm Air

The mid-year convention of the National Warm Air Heating and Air Conditioning Association is to be held at the Deshler-Wallick Hotel, Columbus, Ohio, on June 16, 17 and 18. Tuesday, June 16, will be given over to a meeting of the board of directors and of committees.

President W. L. Rybolt is chairman of the Wednesday morning (June 17) session. Following registration and a message from the president, there will be a talk on merchandising by R. D. Marshall of Bloomington, Illinois; "Why Not a Profit from Air Conditioning," by Harold S. Sharp, Cleveland, Ohio; and "Pre-Fabricated Ducts" by Harry R. Jones of Columbus, Ohio.

Perl S. Miller is chairman of the noon luncheon in the Hall of Mirrors at the Deshler-Wallick. C. A. Sundberg, a well-known humorist, will give an enjoyable talk on-"The Sense in Nonsense."

First vice-president L. R. Taylor is chairman of the Wednesday (June 17) afternoon session. The program includes "Research in Summer Cooling" by M. K. Fahnestock, University of Illinois; "Automatic Controls for Warm Air Heating and Other Phases of Air Conditioning" by Burton Shaw of Des Moines, G. D. Kingsland of Minneapolis, and E. B. Lau of Dayton, Ohio.

On Thursday morning with President W. L. Rybolt presiding, Professor J. D. Hoffman, chairman, will present a committee report on installation codes. F. G. Sedgwick, Research Committee chairman, will read the Research Advisory Committee report; A. P. Kratz will present "A Resume of Our Research Work on Forced Air Heating and Its Practical Applications," and S. Konzo, Special Research Associate of the University of Illinois, will speak on "Performance of Oil Burning Furnace in Research Residence."

The annual golf tournament will be at 1:30 on Thursday afternoon at the Columbus Country Club.

The railroads have discontinued the certificate plan, but new rates make the cost of travel to the convention about the same as heretofore.

New Jersey

The Air Conditioners Association of New Jersey was organized on May 18 at 405 Federal Trust Bldg., Newark, New Jersey.

The following officers were elected: President, Anthony Menke of Newark; Vice Presidents, R. F. Stengel of Irvington, William E. Parkin of Summit, and William J. Steinbrecher of Lakewood; Secretary, Robert A. Mager of South Orange; Treasurer, Edward H. Kuhles of Irvington; Directors, Robert Rice of East Orange, Howard C. Adams of West Orange, Lee Binns of Newark, and Walter Trubenback of Newark.

The purpose of the association is to form an organization of men who have reputations for quality of service in selling and installing air conditioning systems and to unite them in bonds of friendship and progressive cooperation for mutual protection and benefits. Also to co-operate with city councils and other groups in legislative movements which tend to protect owners of residences and business buildings against unsatisfactory and inefficient air conditioning systems.

A constitution and by-laws consistent with these policies were adopted. An air conditioning code similar to codes adopted by legislatures in other states will soon be submitted by the Code Committee of the Association.

A School of Air Conditioning Engineering will be conducted Monday evenings at eight o'clock by the Educational Committee, composed of experienced air conditioning engineers and practical installation experts. The course will include accurate methods of calculating heat losses in winter installations and heat gains in summer cooling systems. It will also include layouts and practical installation suggestions.

Talks on successful methods of advertising and selling air conditioning systems will be arranged for by the sales promotion committee.

R. A. Mager,
Secretary.

◆

LaSalle-Peru, Ill.

The LaSalle-Peru Sheet Metal Contractors Association consists of the following firms—Robert T. Herrcke, First Street, LaSalle; Radtke Hardware Co., Eighth Street, LaSalle; Peru Sheet Metal Shop, Peru; Soedler Hardware Company, 1723 Fourth Street, Peru. Charles L. Radtke is president of the association, and Charles G. Soedler is secretary and treasurer.

The association is looking forward to a busy and prosperous 1936. More money seems to be in circulation and reports of new house construction are increasing. In addition, there seems to be a growing number of remodeling and repair contracts in which heating is included. Last winter's severe weather damaged furnaces and boilers and this repair work will undoubtedly be let to contract during the summer. The association also believes that a considerably increased number of semi- or winter air conditioning jobs will be purchased by home owners and small commercial establishments.

C. G. Soedler,
Secretary.

◆

Queens, N. Y.

1936 officers of the Queens Roofing, Sheet Metal and Residing Contractors Association are: President, A. H. Kessel; vice president, George F. Brown; secretary, Herbert Kraus; treasurer, Henry F. Natemeyer; governors, Sidney Waschberger, Peter Ryan, Arthur Zimmer, Clifford Sparks, Louis Klein, David Nutkis, Jacob Lang, David Schmerer, Oscar Sepner and Joseph Frankel. S. Clinton Stern, 70-12 Roosevelt Avenue, Woodside, Long Island, is executive secretary.

The association is advertising in three Long Island newspapers; maintains a roofing center to educate members to the use and application of various new methods and products, provides a library and social meeting place to serve as a clearing house for complaints, problems and labor difficulties; maintains a free employment service in close conjunction with the New York State Re-employment Service; maintains a blacklist; provides a free credit service to members; a committee on education will visit the various civic and improvement associations in the borough giving enlightening talks on roofing and its history and the importance of the legitimate contractor; provides a full-time secretary and plans to establish a collection service in the center for the benefit of members.

S. Clinton Stern,
Executive Secretary.

◆

Cleveland

The Sheet Metal Employers' Association, 4408 St. Clair Avenue, Cleveland, Ohio, elected the following officers and directors for their association:

Jefferson Pennell, president; Milton Thesmacher, vice president; M. J. Cutter, secretary-treasurer; Directors: D. A. Mannen, Milton Thesmacher, Jefferson Pennell, Wm. E. Feiten, John C. Boehm, and Art Franck.

During June the committee having charge of the 1937 Ohio convention will meet to discuss plans for making the convention a big success. The convention is scheduled to be held in Cleveland in March, 1937.

M. J. Cutter, Secretary.

Philadelphia

The association of Roofing, Metal and Heating Engineers of Philadelphia has elected the following officers and directors for 1936:

President, Joseph V. Kelly; vice president, J. B. Churchill; treasurer, Oliver Bartholomew; secretary, Fred U. Ritter. Directors: John Frick; John Naegele, Jr.; Edward Spence; Walter Rhea; Harry Kulzer; Weston Clark; Charles Salinger; Charles F. Geissler. Certified Roofing Committee: Charles Salinger, John Frick, Harry Kulzer, John Naegele, Jr. Certified Heating and Air Conditioning Committee: Weston Clark, J. B. Churchill and B. F. John.

The association believes it has an interesting proposition in the separate meetings of groups to discuss means to improve roofing, sheet metal, heating and air-conditioning work individually. Several meetings have already been held for most of the groups. Progress has been made in newspaper advertising, preparation and distribution of circulars, specifications and rules of procedure. The association is purchasing space in the classified advertising page to announce that the roofers in the association have organized as a group of responsible firms to supply specifications and install "certified roofing."

The advertisement announces that the association supervises the application and guarantees all such certified roofs. Property owners are invited to write to the secretary for full details.

F. U. Ritter, Secretary.

◆

Milwaukee

At the last meeting of the Master Sheet Metal, Heating & Ventilating, Air Conditioning Contractors Association of Milwaukee, in June, it was announced that the Wisconsin Industrial Commission is now ready to distribute the new state heating, ventilating and air conditioning code. Copies of the code will be mailed to the members; non-members may receive copies by addressing the commission.

The Mechanical Warm Air Heating and Air Conditioning School which is in process was discussed and after due consideration it was decided that the association should not sponsor the school.

The annual picnic of the association will be held July 15 at Mequon Park Tavern.

Paul L. Biersach, Secretary.

◆

Detroit

The following officers have been elected for 1936, to serve The Detroit Association of Warm Air Heating and Air Conditioning Contractors, Inc.:

President—E. H. Wentworth;
Vice President—M. L. Thackaberry;
Treasurer—J. S. Clark;
Secretary—C. A. Winters.
Directors: J. L. Sherk, C. A. Strand and Jay Barton.

C. A. Winters, Secretary

THE PROBLEM CORNER

Friction Chart

American Artisan:
G. A. Voorhees,

I have read with interest your very able article in the January issue of "The American Artisan." In addition to reading and working out the problem which you used to illustrate the use of the friction chart, I also worked out several of my past installations so as to more firmly fix the method in my mind.

In practically all cases I have used high wall registers with standard sized stacks. Your problem dealt with the basement duct to a floor register. I would like to ask you whether it is necessary to figure straight through to the register and should I size the wall stack by the same method or is this practical.

Eight out of ten jobs this Fall have been forced air and I figured them all as to duct size by the mechanical code. All are working very nicely and I found it necessary to do very little dampering to balance them, which I am quite well aware is due more to luck than sense.

D. S. C., N. Dakota.

Reply by
G. A. Voorhees

It is undoubtedly true that a riser to either a second floor register or a high side wall first floor register creates **some** "suction" effect.

In a plant designed for very low duct velocities, this suction effect would be enough to take into consideration in the design of a plant, but at riser velocities of 400 f.p.m. or more, I believe we should entirely disregard any such aspirating effect.

My suggestion would be to figure the duct length straight through to the register in all cases.

I have tried at various times to calculate from the conventional theoretical draft formula, the probable reduction in pressure loss of a warm air run due to a riser, but have never been able to reconcile the theoretical result thus obtained with the actual performance. This may have been due to the fact that my tests have necessarily been crude in comparison with the very precise tests conducted at the University of Illinois, but I believe that the unpredictable "shock losses" due to dampers and other unknown factors make it wholly impractical for us to attempt to apply the extremely small corrections which would result from taking into account the "chimney effect" of the risers.

Valley Leaks

American Artisan:

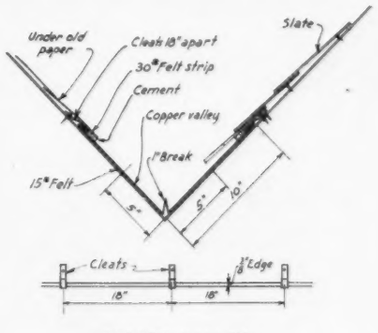
We have a house with a slate roof and metal valleys. These valleys are only 14 inches wide and in winter under snow and ice they fill up and when the snow melts water runs into the house. We figure a wider valley would cure this trouble, but would like to know just how to remove the slate and install the wider valley?

F. S., Illinois.

Reply by
F. Appleton,
John Weenink & Sons Co.,
Cleveland, O.

You do not give all the information necessary regarding the pitch of the roof, that is, whether or not both pitches are the same; however, we think that the following information will enable you to make a repair that will be watertight:

Remove the slate back about 2 ft. on each side of the center of the valley, and then remove the old metal.



COPPER VALLEY

Lay a sheet of 15-pound felt in this place, and over it install a new valley of material 20" wide. In the center of this material make a 1" V-break, and at the outer edges turn a ⅜" edge. Install this valley with cleats spaced every 18". Do not drive nails through the valley material. Over the outer edge on each side of the valley lay a strip of 30-pound felt 10" wide thoroughly embedding it in plastic cement.

After this, relay the slate, leaving an opening 5" back on each side of the center of the valley.

If the above information is carefully followed, you will have no further trouble with leaks.

Model Boiler

American Artisan:

I have to build a model boiler scaled to a locomotive boiler. The scale calls for 20-gauge black iron. I wish to carry 100 pounds steam pressure. Will this gauge of black iron carry this pressure? The model boiler will be 5⅜ inches in diameter and 30 inches long.

E. L., Missouri.

Reply by
the Editors

According to a recognized formula for selection of gauge of material required to carry 100 pounds of steam pressure, and further checked by inquiry among jobbers of boiler tube sections, and still further checked against the Mechanical Engineers' Handbook, you should use probably 8 or 9-gauge metal for the model you refer to.

We suggest that you call a boiler tube jobber and put your problem before them. They can probably give you suggestions as to how to buy tubing to carry this pressure.

Galvanized Smoke Pipe

A problem presented in the April issue by a Wisconsin reader asks how to eliminate peeling of the galvanized coating on smoke pipe. The following suggestion is offered:

"The most practical way of preventing peeling from a smoke pipe is to make the pipe of long terne sheets and then galvanize the pipe after formation. A light-coated, long terne sheet should be used which will form into a pipe as readily as galvanized iron. After forming, the pipe should then be hot galvanized in a local plant.

—E. H. Hoffeld.
The Ferdinand Dieckmann Co.,
Cincinnati, Ohio.

Heinz Fleche

(*Continued from page* 13)

"At point 7, the gargoyles assume large size. Each gargoyle was stamped in several pieces such as top, two sides, mouth, breast, base, etc., to be assembled by Overly. The Gothic tracery in the panels at point 8 below the sills of the openings above, form the face of the spire and also form open windows behind the pinnacles. The design required elaborate formation of the tracery .

"The pinnacles at point 9 duplicate on larger scale those of point 3. The area of the spire face behind the pinnacles is filled with a detailed panel formed of numerous small pieces raised from a solid background and forming the face of the spire.

Tracery

"The photograph showing one of the tracery sections (points 11 and 13) being placed in position shows the perfection of detail and by the numerous soldered seams indicates the large number of small pieces stamped by Miller and Doing and assembled by Overly to provide erection as a complete unit.

"The openings below these panels are outlined by a deep reveal which includes an ornamented arch and several setback sections of round and rectangular cross section. These reveals were supplied as horizontal sections assembled and soldered together and to the sills in the Overly plant and erected as a unit. The erection photograph shows these units clearly.

"Below the base of the openings the buttresses are plain faced and gabled in rectangular cross section and stamped in horizontal section as shown clearly in the closeup of the fleche. Between these buttresses, there are three panels, the top panel being solid with raised tracery incorporating two designs and standing out beyond the sill above. Below this is another panel belt, also solid with raised tracery, both belts being supplied to Overly as several pieces and assembled for erection as a between-buttress panel."

Molds, Stamping

The herringbone panels forming the base faces of the spire were fabricated by Overly with a circular ornament as shown in the photograph supplied by Miller and Doing.

From elevation 397'—7¼" to the top the faces were stamped as several panels together, but from 397'—7¼" down each face was made in several small pieces. In performing the stamping operations, Miller and Doing made full sized clay models from sized details prepared by Overly for each section of the work. All of these models were submitted to the architect for approval. The forming dies were made in numerous small sections according to the depth of the forming required. The deeper the formation the larger the number of die pieces as the heavy copper used did not permit of much metal flow and the architect insisted that no part of any stamping should show a thinning due to the pull of the dies. After stamping each piece was dipped for a 25-pound lead coating.

Main Roof

The main roof at the base of the fleche and the smaller roofs of the transept and clerestory are covered with 16-ounce copper with a 25-pound lead coating applied over a concrete slab. The usual batten type of construction was followed with

(*Continued on page* 84)

News Items . . . . . .

FHA Mortgage Clinics

Federal Housing Administration, Washington, D. C., reports on May 20 applications resulting from one year of mortgage clinics totalling $116,032,887, through 1,119 mortgage clinics since their inception in Johnstown, Pennsylvania, May 15, 1935.

During the 12 months ending May 15, 1936, 50,957 individual interviews have been given at mortgage clinics conducted in the 48 states and the Territory of Hawaii.

◆

Social Security Regional Directors

Announcement of the names of twelve Regional Directors and the locations of the twelve regional offices which it will set up throughout the country was made at Washington, D. C., on May 21, by the Social Security Board. The Board plans to have these offices fully functioning by the first of June. The Regional Directors announced will head staffs which will represent in the various regions the Social Security Board in the administration of the public-assistance, unemployment compensation, and Federal old-age benefits provisions of the Social Security Act.

The regions, the regional headquarters, and the Regional Directors for the twelve regions are as follows:

Region 1—Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut: John Pearson of Concord, New Hampshire, Director; Regional Headquarters, Boston, Massachusetts.

Region 2—New York State: Mrs. Anna Rosenberg of New York City, Director; Regional Headquarters, New York City.

Region 3—Pennsylvania, Delaware, and New Jersey: Judge W. L. Dill of Paterson, New Jersey, Director; Regional Headquarters, Philadelphia, Pennsylvania.

Region 4—District of Columbia, Maryland, North Carolina, Virginia, West Virginia: G. R. Parker of New York City, Director; Regional Headquarters, Washington, D. C.

Region 5—Ohio, Kentucky, Michigan: Benedict Crowell of Cleveland, Ohio, Director; Regional Headquarters, Cleveland, Ohio.

Region 6—Illinois, Indiana, Wisconsin: H. L. McCarthy of Chicago, Illinois, Director; Regional Headquarters, Chicago, Illinois.

Region 7—Alabama, Georgia, Florida, Mississippi, South Carolina, Tennessee: Steve Nance of Atlanta, Georgia, Director; Regional Headquarters, Birmingham, Alabama.

Region 8—Minnesota, Iowa, Nebraska, North Dakota, South Dakota Fred M. Wilcox of Madison, Wisconsin, Director; Regional Headquarters, Minneapolis, Minnesota.

Region 9—Missouri, Arkansas, Kansas, and Oklahoma: Ed McDonald of Oklahoma City, Oklahoma, Director; Regional Headquarters, Kansas City, Missouri.

Region 10—Texas, Louisiana, New Mexico: O. M. Powell of San Antonio, Texas, Director; Regional Headquarters, San Antonio tentatively under consideration.

Region 11—Colorado, Arizona, Idaho, Montana, Utah, Wyoming: Heber Harper of New York City, Director; Regional Headquarters, Denver, Colorado.

Region 12—California, Nevada, Oregon, Washington: Richard M. Neustadt of San Francisco, California, Director; Regional Headquarters, San Francisco, California.

◆

Importance of Low-Income Consumers

Studies of nine cities—Austin, Texas; Fargo, North Dakota; Portland, Maine; Columbia, S. C.; Salt Lake City, Utah; Trenton, New Jersey; San Diego, California; Racine, Wisconsin; and Birmingham, Alabama, by the Bureau of Foreign and Domestic Commerce, Department of Commerce, reveal that families with incomes of less than $1,000 stand out as large users of most modern equipment produced for family consumption. These studies include data on reported use of building materials in 1934, heating apparatus, fuel, lighting facilities, installed bathtubs and showers, refrigeration and automobiles.

Highlights from the Birmingham report show that families below $1,000 in income occupy more than half of all reported single-family dwellings and have one-fourth of all homes equipped with central heating plants. Approximately 30 per cent of these small-income families are home owners.

Now

a Furnace Cement--that can take it

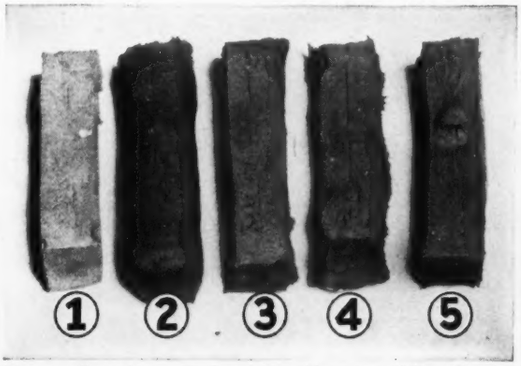
IRONSET

a new discovery by the producer of **FIRELINE**

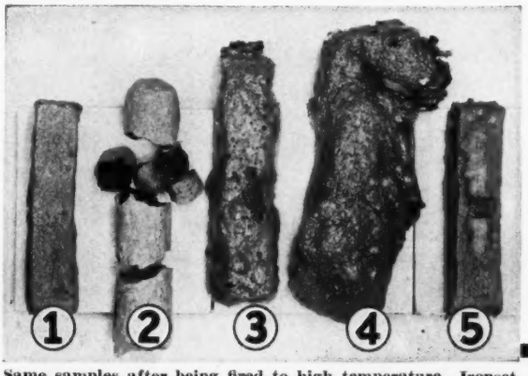
Frankly, IRONSET may cost you 10c per furnace more than the cheapest furnace and boiler cements, but for that extra 10c you can be sure of a gas tight job that will *stay* gas tight—of safe joints and connections that will remain *safe*—of satisfield customers who will keep on being *your* customers.

Because IRONSET will not shrink, crack, bloat or blister, because it forms a *strong* bond, adheres to all surfaces and still has universal resiliency and will "*give*" and "come back" when castings expand and contract and because it will withstand any temperature attained in domestic plants and appliances (above 1800 F), it is certain to make a perfect and lasting seal on any domestic application.

Will not crack, shrink, bloat nor blister



Comparative test of Ironset with competitive furnace cements showing condition after being dried to temperature of 225 deg. F. All samples were identical in size and shape when test was begun. Ironset sample, at left, practically unaffected by test.



Same samples after being fired to high temperature. Ironset samples, at left, still in good condition while other samples have been badly deformed. (This photograph not same reduction as above picture.)

Insure every job and your reputation with IRONSET on Furnaces, Boilers, Smoke Pipes, Stoves, Ranges, Fireplaces, Incinerators, Stokers, Water Heaters—even for setting Fire Brick. Pin this NO RISK ORDER BLANK to your letterhead and your order will be shipped by your jobber.

No Risk Order Blank

Ship 1 case of IRONSET as checked.

	Net Case Price F.O.B. Shipping Point
( ) 36 1-lb. cans	$3.24
( ) 24 2½-lb. cans	4.85
( ) 12 5-lb. cans	4.20
( ) 6 10-lb. cans	4.20
( ) 50-lb. drum	3.50
( ) 100-lb. drum	5.50

Jobber .....

Signed .....

To
FIRELINE STOVE & FURNACE LINING CO.
1866-F Kingsbury St., Chicago.

This order is given with the complete understanding that if IRONSET does not prove the finest Furnace Cement that you have ever used, all or any portion can be returned within 30 days and purchase price plus transportation will be refunded.

Social Security

(*Continued from page 21*)

ing with so-called Old-Age Assistance:

TITLE I—GRANTS TO STATE FOR OLD-AGE ASSISTANCE:

"Sec. 2(a)—A State plan for Old-Age assistance must (1) provide that it shall be in effect in all political subdivisions of the State, and, if administered by them, be mandatory upon them; (2) provide for financial participation by the State; (3) either provide for the establishment or designation of a single State agency to administer the plan, or provide for the establishment or designation of a single State agency to supervise the administration of the plan; (4) provide for granting to any individual, whose claim for old-age assistance is denied, an opportunity for a fair hearing before such State agency; (5) provide such methods of administration (other than those relating to selection, tenure of office, and compensation of personnel) as are found by the Board to be necessary for the efficient operation of the plan; (6) provide that the State agency will make such reports, in such form and containing such information, as the Board may from time to time require, and comply with such provisions as the Board may from time to time find necessary to assure the correctness and verification of such reports; and (7) provide that, if the State or any of its political subdivisions collects from the estate of any recipient of old-age assistance any amount with respect to old-age assistance furnished him under the plan, one-half of the net amount so collected shall be promptly paid to the United States. Any payment so made shall be deposited in the Treasury to the credit of the appropriation for the purposes of this title."

"Sec. 2(b)—The Board shall approve any plan which fulfills the conditions specified in subsection (2), except that it shall not approve any plan which imposes, as a condition of eligibility for old-age assistance under the plan—

"(1) An age requirement of more than sixty-five years, except that the plan may impose, effective until January 1, 1940, an age requirement of as much as seventy years; or

"(2) Any residence requirement which excludes any resident of the State who has resided therein five years during the nine years immediately preceding the application for old-age assistance and has resided therein continuously for one year immediately preceding the application; or

"(3) Any citizenship requirement which excludes any citizen of the United States."

"Sec. 4—In the case of any State plan for old-age assistance which has been approved by the Board, if the Board, after reasonable notice and opportunity for hearing to the State agency administering or supervising the administration of such plan, finds—

"(1) that the plan has been so changed as to impose any age, residence, or citizenship requirement prohibited by section 2(b), or that in the administration of the plan any such prohibited requirement is imposed, with the knowledge of such State agency, in a substantial number of cases; or

"(2) that in the administration of the plan there is a failure to comply substantially with any provision required by section 2(a) to be included in the plan;

the Board shall notify such State agency that further payments will not be made to the State until the Board is satisfied that such prohibited requirement is no longer so imposed, and that there is no longer any such failure to comply. Until it is so satisfied it shall make no further certification to the Secretary of the Treasury with respect to such State."

"Sec. 6—When used in this title the term 'old-age assistance' means money payments to aged individuals."

From the above quotations it can readily be seen that the Federal Government will, if the State enacts satisfactory legislation covering monthly payments to aged needy persons, refund (up to $15.00) one-half of any such payment made by the State.

Thirty-five States now have Old-Age Pension laws, and thirteen

THE STANDARD OF QUALITY

Photo: N. B. Aukerman

WHAT a beautiful thing is a piece of Wedgwood Queensware — its exquisite glazing, lustre and delicate hand embossing have never been duplicated. It is the standard by which all others are compared.

Equally admirable from the standpoint of both engineering and fine appearance is Independent "Fabrikated" construction. It is distinguished by modern design, wonderful strength and rigidity and beautiful finish. Independent "Fabrikated" is the standard of quality in floor register and cold air face construction.

From the extensive Independent line you can specify all your needs in registers, cold air faces and grilles.

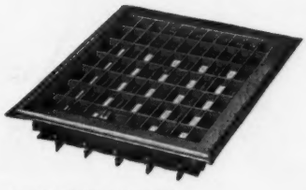
Send for catalog

THE INDEPENDENT REGISTER CO.
3741 EAST 93rd STREET CLEVELAND, OHIO

INDEPENDENT "Fabrikated" REG. U. S. PAT. OFF.

FLOOR REGISTERS AND COLD AIR FACES

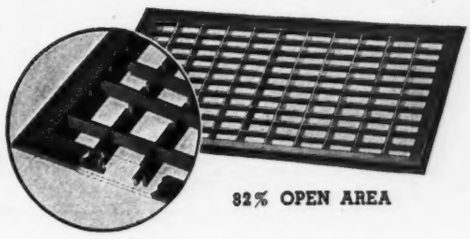
AND AIR CONDITIONING REGISTERS AND GRILLES



STANDARD MESH

CLOSE MESH

ANY SIZE



82% OPEN AREA

ANY FINISH

have none. Some of the State laws do not meet the full requirements of the Federal Security Board, and until these state laws are satisfactory the Federal Social Security Board will not approve the State Act and pay to the State one-half (up to $15.00) of whatever pensions the State has actually paid to its aged needy citizens.

The following States have laws acceptable:

Alabama	New Hampshire
Delaware	New Mexico
Idaho	Rhode Island
Iowa	Vermont
Maine	Washington
Maryland	Wisconsin
Michigan	Wyoming
Mississippi	District of Columbia
Missouri	
Nebraska	

The following States have Old-Age Pension Laws which, as passed by the State Legislatures, do not conform to the board's requirements, but do authorize "the proper State officials" to amend, modify or suspend such provisions as are not satisfactory:

Arkansas	Florida
California	Massachusetts
Colorado	New York
Connecticut	Oklahoma

And the following States have thus far asserted their belief in State Sovereignty and passed laws they feel were best suited to their needs, and, by so doing, are not to receive Federal subsidies for Old-Age Pensions:

Illinois	Ohio
Kentucky	Oregon
Minnesota	Texas

From the foregoing it should be evident that we, as citizens, both of the State and the Nation, will be called upon to pay the taxes necessary for Old-Age Assistance. Why, too, will not the cost be less if we pay it all to the State not to both State and Federal governments.

Heinz Fleche

(*Continued from page* 80)

the batten expansion space cut into the base of the batten. Flat locked (unsoldered) cross seams of special design and separate batten caps were adopted.

Scaffold

Of some interest is the scaffolding shown in the erection photograph. W. F. Overly says of the scaffold: "The matter of scaffolding from which to apply the material of the fleche proved of some concern. We not only had to build the scaffold, but do so at the lowest possible cost. The architect naturally assumed that the metal would be applied from a free standing scaffold, as this has always been standard practice, but we worked out with the structural steel erectors, McClintoc-Marshall, a plan wherein the steel men placed steel brackets (consisting of a heavy horizontal channel and upright angle for the fence and braced below with a diagonal angle) up and down the hip steel at close intervals. In this steel work we laid our planking.

"Application of the copper began at the tip of the spire and came down, and as we worked down the spire we removed these temporary brackets. We found this to be a very practical and safe method of scaffolding."

Industrial Advertisers:

ON TO PHILADELPHIA

Again, National Industrial Advertisers Association presents a national conference designed not only to help industrial companies to solve many of their sales and advertising problems, but to point the way for heavy industry to take its rightful place in American business. Prominent speakers will discuss:

The Importance of Heavy Industry in the Future of the U. S. A.

Industry's Public Relations Problem.

Improving Advertising through Better Company Organization.

The Place of the Agency in Industrial Advertising.

Introducing a New Product.

Advertising Department Problems.

You can't afford to miss these meetings. Plan now to be there and bring MANAGEMENT with you. Register now; use the coupon.

October 5, 6, 7 — Benjamin Franklin Hotel, Philadelphia.

Heavy Industry to the Front!

MR. LOUIS A. CLEAVER,
F. W. Dodge Corporation,
1321 Arch St., Philadelphia, Pa.

Please find enclosed check for seven dollars, covering complete conference costs (including banquet and smoker).

Please reserve _____ rooms at Benjamin Franklin Hotel.

Name _____ Company _____

Address _____

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 100.

257—Humidifier Leaflets

Two new leaflets on humidification are announced by the Hubbard Company, 1014 Marquette Avenue, Minneapolis, Minnesota. The first leaflet entitled "Facts" is arranged to give the prospect information on the desirability of adequate humidity indoors. The leaflets explain the Hubbard humidifying system which consists of a cabinet heated by the smokepipe and containing filters, a small blower and a humidifier spray. Air is brought to the blower from outdoors or from the house, heated and humidified and introduced into the rooms to be humidified. The system is intended primarly for radiator heated houses and is claimed to maintain up to forty percent relative humidity.

◆

258—Increase Profits and Sales

Breur Electric Mfg. Co., 864 Blackhawk Street, Chicago, Illinois, is offering a new furnace and boiler cleaning sales plan for dealers, entitled "How to Increase Profits and Sales," with details of free trial offer and terms on the Tornado Furnace and Boiler Vacuum Cleaner.

The Tornado furnace and boiler vacuum cleaner made in two sizes is illustrated and described in a folder being distributed by the makers. The soot is caught in a throw-away paper bag container inside the metal tank. The cleaner can be converted into a portable blower for blowing light dust from furnace pipes, motors, etc.

◆

259—Dailaire De Luxe Furnace

Dail Steel Products Co., Lansing, Michigan, is distributing a new circular covering their new Dailaire Deluxe unit with a counter-flow air principle. The Dailaire Deluxe system of heating and air conditioning provides all stages of air conditioning in one casing, preheating, filtering or washing, humidifying, heating and circulating the air. Summer conditioning is also possible with the Dailaire by adding positive cooling by water or refrigeration within the same unit—plus air cleaning and air circulation.

The unit employs a wedge shaped dome and flue construction with the dome of Armco stainless chromium steel. Casings are finished in a gloss green finish and trimmed with Armco stainless steel. The Dailaire system provides for the burning of gas, oil or coal (stoker or hand fired.)

◆

260—Blower Catalog

Autovent Fan & Blower Co., 1805 N. Kostner Avenue, Chicago, is distributing a new catalog covering their complete line of fans, blowers and unit heaters. The catalog consists of a loose-leaf binder containing their various bulletins.

◆

261—Register Catalog

Waterloo Register Company, Waterloo, Iowa, announce Catalog No. 16 covering air conditioning registers and grilles. The unusually complete catalog shows each of the type of air-conditioning registers with suitable pictures and drawings showing proper installation methods and angle of air flow through the grille in its various positions of adjustment. Registers in the line include directional flow—one-way two-way, three-way, four-way; right or left, up or down or both. The catalog also contains full data on the base-board intakes with and without frame; the jet control type of grille, grilles of wrought steel and various register equipment; as well as full price information on the various types and finishes of units. Additional information shows air delivery in C. F. M. at various velocities through register faces of different sizes; resistances of registers and grilles for different velocities; distance of throw at different velocities; spread of air for different types of registers and similar useful data.

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 100.

262—Arc Welding Electrodes Booklet

A new booklet, elaborately illustrated and discussing in detail the general characteristics of electrodes and arc welding accessories, is announced by Lincoln Electric Company, Cleveland, Ohio. The company's patented "shielded arc" process is explained in detail, together with drawings showing why this particular method is advantageous. Properties of metals and the proper electrodes for use with various types of metals are presented in tabular form together with complete discussion. Many photographs showing typical uses of the various types of electrodes are also contained in the booklet. Accessories such as electrode holders, tables, shields and clothing are also covered by illustration and explanation.

◆

263—Ventilating Fan

CirCOOLator, a new portable fan housed in a modernistic cabinet and sized and designed for interior installation to circulate large volumes of air quietly, is shown in illustrations and described in text in a pamphlet just issued by Viking Air Conditioning Corp., Cleveland, Ohio. In addition to popular explanation of the advantages of large volume air circulation in houses and commercial establishments, the leaflet explains by means of drawings just why ventilation brings about cooling.

◆

264—Residential Air-Conditioning Unit

The Forest City Foundries Company, Cleveland, Ohio, has just issued an 8-page, 4-color folder on the Niagara Gas Air-Conditioning Unit for residential use.

Noteworthy features are two diagrams which show the operation of the Niagara 2-speed direct-connected blower and the functioning of the Niagara thermo-syphon counter-flow system of heat extraction and circulation. Space is provided for dealer imprint.

◆

265—Properties of Toncan Iron

Republic Steel Corporation, Cleveland, Ohio, producers of sheets, pipe, plates, strip, bars, wire, shapes, tubes, rivets, bolts, nuts and screws, has just issued a small 12-page leaflet entitled "Properties of Toncan (Copper Molybdenum) Iron."

Tocan Iron is a short name for Toncan Copper Molybdenum Iron, a highly refined open hearth iron with which is alloyed the correct proportion of copper and molybdenum. The resulting iron, they say, possesses a maximum resistance to rust and corrosion among ferrous materials.

Toncan Iron can be worked easily, they say, either hot or cold. It can be welded by gas or electric process, soldered, brazed, riveted, spun, etc. It may be coated with various protective coatings, also galvanized, sherardized, tin and terne-coated.

◆

266—Oil Burning Furnace Catalog

The Waterman-Waterbury Company, Minneapolis, Minnesota, announce a new color catalog describing the Comfortrol Oil-O-Matic oil burning furnace and conditioner. The new conditioner consists of the company's steel oil burning furnace with extra radiation capacity, to which is attached a blower-filter unit all housed inside one specially designed casing finished in light green and trimmed in chromium. The burner is installed behind a special front panel which hides the burner. A new feature is the adjustable built in humidifier so designed that the rate of evaporation can be controlled to suit requirements. Provision has also been made for the installation of a cooling coil for cold water or refrigeration.

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 100.

267—Shears and Presses

Marshalltown Manufacturing Company, Marshalltown, Iowa, and Chicago, Illinois, manufacturers of punch presses, shears and bending rolls, has recently issued a folder illustrating and describing their new Marshalltown shear for cutting inside circles or irregular shapes—either 12- or 16-gauge capacity.

Marshalltown Throatless Shears are built in several different sizes with capacity up to and including boiler plate, and they say will cut in and out curves to 1¾-inch radius.

◆

268—Portable Electric Tools

The Black & Decker Mfg. Co., Towson, Maryland, has just issued a new electric tool catalog. Portable electric tools, drills, screwdrivers, nut runners, tappers and sanders—used in building, assembling and in the installation of heating, ventilation and air conditioning equipment. Copies are available.

◆

269—Air-Conditioning Booklet

Buffalo Forge Company, Buffalo, New York, announces Bulletin 501 describing the Type "PC" cabinet for air conditioning. Illustrations and text explain the features of design and application of the suspended and floor cooling and air-conditioning units. Valuable data on surface cooling, direct expansion coils, water cooling coils, air capacities, air resistances, speed and horsepower tables are presented. Charts are explained with relationship to particular problems, as for example how to use the chart in selecting the size and type of coil to be used in surface cooling with water, direct expansion and ice. Very interesting is a typical example of the cooling and air-conditioning installation for a restaurant in which suggested conditions are set up and the entire engineering plan is worked out step by step.

◆

270—Combustion Recorders

The Hays Corporation, P. O. Box 299, Michigan City, Indiana, has just published a new catalog, RA-346, covering their line of combustion meters—of interest to heating engineers. The catalog contains a complete description of Hays instruments and engineering data on their application.

◆

271—Perfection in Oil Heat

Bethlehem Foundry & Machine Company, Bethlehem, Pennsylvania, has published a new booklet entitled "Modern Perfection in Automatic Oil Heat" intended for general distribution to consumers, architects, heating engineers and builders. It is Bulletin No. CF-2, and illustrates and describes the latest Bethlehem-Doe Oil Burners. The makers claim the Bethlehem-Doe is able to operate on the heavier, least expensive grades of oil, that it is fully automatic and noiseless.

◆

272—Exhaust Fans—Attic Ventilators

The Peerless Electric Co., 1401 West Market Street, Warren, Ohio, is distributing Bulletin No. 208, showing their standard line of exhaust fans and ventilating equipment for 1936.

A new low-priced attic ventilator is fully illustrated and described on the back cover. The motor and fan are encased in a protective housing which in mounting is suspended from the ceiling or rafters by coil springs for extreme quietness. It can be installed to discharge through a window or through an opening cut through the wall. Capacity is 3500 to 5500 c.f.m.

New Literature . . . .

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273—Sheet Metal Machinery

Ward Machinery Co., 564 W. Washington Boulevard, Chicago, is distributing Bulletin 36—Latest Design for Machines for Sheet Metals—with prices effective May 1, 1936.

◆

274—Handy Reference Catalog

Barnes Metal Products Co., 4425 West 16th Street, Chicago, is distributing "Handy Reference Catalog" No. 136, containing useful information on Barnes conductor pipe, elbows, eaves trough and fittings in all sizes and of all metals; with standard list prices. Illustration and price lists cover all the Barnes products.

◆

275—Round Oak "L" Series

Round Oak Company, Dowagiac, Michigan, is distributing a new small folder illustrating and describing the special features of the new "L" Series Round Oak Moist-air-Blended-Iron furnace. Specifications cover two sizes. All Round Oak furnaces are designed for operation with or without air conditioning units. Space is provided for the dealer's imprint.

◆

276—New Barber-Burner Catalog

The Barber Gas Burner Company, 3704 Superior Avenue, Cleveland, Ohio, is just issuing a new Barber Burner Catalog No. 37. This 40-page book includes the new type Barber units, as well as a compilation of additional engineering data of value to the gas industry and to the heating and appliance trade.

277—Airtemp Year Round Air Conditioning

Airtemp Incorporated, Detroit, Michigan, is distributing a new 4-page folder SF 132, entitled "Complete Year Round Comfort," showing its complete system which consists of a compressor, a conditioner and an automatic boiler-burner, all automatically controlled, and in two sizes.

Airtemp also makes an oil burner, fully illustrated and described in Folder L-310.

◆

278—Niagara Power Squaring Shears

Niagara Machine & Tool Works, 637 Northland Avenue, Buffalo, is distributing Bulletin No. 71-F, 28 pages, illustrating and describing Niagara power squaring shears for straight, accurate cutting, with capacities for shearing up to No. 10 gauge mild steel and lighter. Machines are built in nominal cutting lengths of from 30 to 192 inches. Gap shears for slitting sheets longer than the cutting length of the shear are also listed.

◆

279—Arco Air Filters

American Radiator Company, 40 West 40th Street, New York City, is distributing an 8-page, 8½x11 folder, describing and illustrating Arco replacement filters constructed of corrugated fibre board, so arranged as to form cellular passages. Each filter is composed of two wafers.

In operation, the dust laden air entering the filter immediately changes direction on a 45 deg. angle, thus causing a scrubbing along the sides of the cellular passages in the first wafer. After leaving the first wafer, the air abruptly changes direction on a 90 deg. angle, scrubbing along the sides of the passages in the second wafer. As dust impinges on the sides of the cellular passages, oil is absorbed by capillary attraction into each dust particle, and that dust particle then becomes the medium for catching other dust particles. There are tables of dimensions for the various types.

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New Literature . . . .

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280—Evaporative Condensers

A recently introduced evaporative condenser designed to reduce water and power costs in refrigerating and air-conditioning installations is explained and shown in a new leaflet by The Trane Company, LaCrosse, Wisconsin. The bulletin is No. 42. Tables of the dimensions and capacities cover all sizes of units and there is also a page devoted to construction details.

◆

281—Time Switch Catalog

A catalog covering Types T-17 and T-27 general purpose automatic time switches is announced by General Electric Company, Schenectady, New York. The leaflet explains various applications of these time switches, such as the operation of lights, signs, hot water heaters and furnaces, refrigerating defrosting, etc. Drawings show the construction of the switches and the text explains just how the unit is installed and operated.

◆

282—Humidifier Folder

A small folder showing and describing details of construction and application for the Skuttle automatic humidifier is announced by The J. L. Skuttle Company, 4308 West Fort Street, Detroit, Michigan. The folder shows photographs of the Skuttle water valve and the various sizes of humidifiers. Text matter explains the materials of construction, specifications for installation and methods of selecting the proper unit.

◆

283—Metal Corrosion Reprint

Republic Steel Corporation, Cleveland, Ohio, announces a reprinted leaflet covering the subject of corrosion of air conditioning ducts. The reprinted article describes the atmospheric conditions which bring about corrosion and explains how corrosion takes effect. Methods for eliminating or minimizing corrosion are explained with suggestions for selecting the proper type of material and properly protecting such material upon installation.

◆

284—Welding, Jig and Fixture Leaflet

The Lincoln Electric Company, Cleveland, Ohio, announces a new leaflet, "A Guide to Lower Tooling Costs with Shielded Arc Welded Steel Jigs and Fixtures." The booklet describes the cost saving permitted by arc welding in the production of jigs and fixtures used by many industries. The booklet shows and describes typical steel jibs and fixtures prepared by welding. Actual service as a unit is given in terms of life and cost, to indicate how arc welding construction saved money.

◆

285—The Story of Air Conditioning

A new booklet under the above title is announced by the Furblo Company, Hermansville, Michigan, with text and numerous illustrations designed to present briefly and clearly the answers to questions most often asked about air conditioning. Among the many interesting items discussed in the booklet are: why some homes are hard to heat by gravity; how a gravity warm air furnace operates; what air conditioning is; what benefits air conditioning brings; why it is easy to install a packaged air conditioner. Pictures and text material explain how the air conditioning unit filters the air of all dust and dirt, how quiet operation is secured, how much attention is required for fan operation, why the application of a fan saves money on the fuel bill, and how a packaged air conditioner can be used to secure some measures of summer cooling. The cost of various types of Furblo apparatus and the design and construction of Furblo equipment is shown in complete detail.

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 100.

286—Inco No. 4 Issue

INCO, Volume XIII, Number 4, published by The International Nickel Company, Inc., 67 Wall Street, New York City, carries a story of the roofing problems of the New York Public Library and the Pennsylvania Terminal. Monel Metal is being used as the replacement material.

◆

287—Revere Minute Man

Revere Minute Man—Number Three, 1936—published by Revere Copper and Brass Incorporated, 230 Park Avenue, New York City, contains an article on "Air Conditioning in Industry," "Tanks and Shower Baths," and "Fatigue of Metals," of interest to sheet metal dealer.

◆

288—High Strength Steel Folder

"Useful Facts About Armco H. T. 50," a folder issued by The American Rolling Mill Company, Middletown, Ohio, describes a special high tensile steel that absorbs 5,000 foot-pounds per square inch in tensile impact tests, and elongates 33 per cent in a 2-inch gage length. This special steel has an endurance limit of 48,000 pounds per square inch as determined by the rotating beam test and is supplied in standard finishes of plates, hot-rolled, hot-rolled annealed sheets and strip, and cold-rolled sheets and strip.

◆

289—Air Conditioning Registers and Grilles

The Independent Register Co., 3747 East 93rd St., Cleveland, Ohio, is distributing Catalog No. 36 AC, showing many new items and revised list prices. Previous issues are obsolete. The full line of air conditoning registers and grilles are illustrated and described.

◆

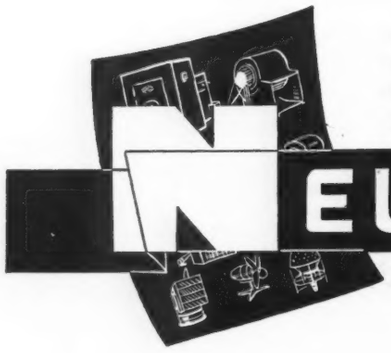
290—Standard Trunk Line

Chandler Company, Cedar Rapids, Iowa, manufacturers of Chandler Healthmaster trunk lines, has published a four-page folder illustrating and describing this product. There are nine sizes of outlet fittings and the same size range in duct, elbows and angles. Tools necessary for installation are a punch, snips, screw driver and hammer. Metal screws securely hold the connections. All fittings are formed from 26-gauge galvanized iron and are electric spot welded. The fourth page is a data sheet with list prices.

◆

291—Automatic Heating and Air Conditioning

A new booklet entitled "This Thing Called Automatic Heating and Air Conditioning" is announced by Minneapolis-Honeywell Regulator Co., Minneapolis, Minnesota. The booklet presents in elaborate form by means of text and illustrations the complete story of automatic control of heating equipment, beginning during the time of the first thermostat in 1885 and the first spring wound damper motor. The progress of control design through advances in thermostats, day and night thermostats, anticipating thermostats, limit controls and fire controls of all types, is explained. In addition, protective controls, circulating pumps for hot water systems, low water cutoffs, high temperature controls, stoker and oil burner switches, gas valves, modulating damper motors, radiator controls, as well as a complete discussion of all the apparatus used for domestic and commercial air-conditioning systems, including heating and cooling, are thoroughly explained. The continuity of the booklet gives the prospect a picture of how operation is made entirely automatic by the use of suitable controls.



For your convenience a number has been assigned each item. Check the items in which you are interested on the coupon on page 100 and mail to us. Complete information will be forwarded.

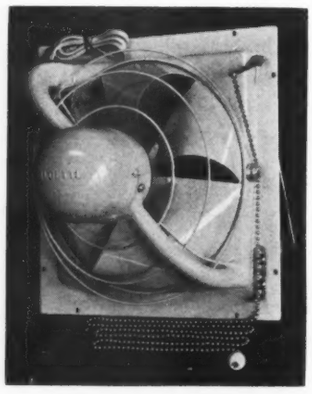
● Indicates product not listed in 1936 Directory

△ Indicates product and manufacturer not listed in 1936 Directory

NEW PRODUCTS

43—Draft Fan

Ilg Electric Ventilating Co., 2850 North Crawford Avenue, Chicago, announce the Ilgette kitchen ventilator in four models for installation in the wall, in the window, and in the transom. Operating data shows a capacity of 400 C.F.M. at 45 watts power consumption, a speed of 1550 R.P.M. with a self-cooled, non-radio interfering motor. The built-in-wall unit comes complete with fan, cabinet and grille. The cabinet is telescopic to fit any depth of wall; a pull-chain opens the louvre



and starts the fan. The portable window unit has an adjustable panel for quick installation or removal. The built-in window unit replaces a pane of glass and measures approximately 12 inches square.

◆

44—Weldmaster

The Modern Engineering Company, 3411 Pine Street, St. Louis, makers of Meco Oxy-Acetylene welding equipment, are in production on their new Weldmaster welding torch. This

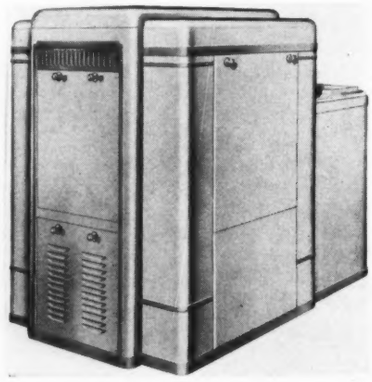
torch with a standard tip weighs only 17½ ounces.

The circle mixer employed has been improved and its capacity increased. Even the largest tips may be used efficiently with low gas pressures.

Weldmaster Torches are made in two types, the Standard and the Super.

45—Conditioner

The Fox Furnace Company, Elyria, Ohio, announces the new DeLuxe, Series D, Sunbeam gas fired air conditioner. The unit is encased in a cabi-



net of heavy 20-gauge, cold-rolled, furniture steel finished in glossy, two-tone green enamel. All bolts and screws are concealed. Corners are gracefully rounded. Proportions have been carefully balanced. Valves, piping, motor and controls are concealed, yet are readily accessible through large removable panels. Heating elements are of cast iron construction.

The new line is made in four sizes ranging from 140,000 to 350,000 B.t.u. input per hour and will burn natural, manufactured or mixed gas.

◆

46—Vesta Fuel Oil Meter

Fluid Meters, Inc., Chrysler Building, New York City, is announcing the Vesta Fuel Oil Meter, a device which measures and records the actual fuel consumption.

The company proposes a service in which fuel oil is stored in the customer's tank, the driver's delivery ticket is entered in the customer's record sheet, and the meter reader leaves the metered bill with the customer when making his reading, the bill being then due and payable, the same as gas and electricity is purchased. The customer pays only for the oil he actually consumes. His supply of fuel is constantly maintained.

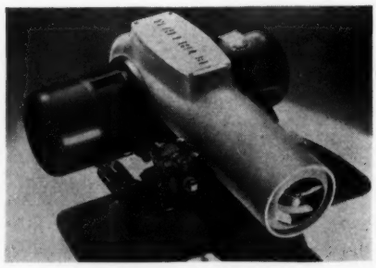
The advantages to the dealer are: the first contract sales cost is the only one for the contract continues as long as the meter stays on the line; delivery trucks can be regularly routed to keep tanks filled without emergency fills; protection against quantity loss as the oil expands to the original temperature adjustment before it passes through the meter; added storage capacity using customers' tanks; and improved credits, collections and accounting for metered bills are promptly paid.

◆

47—Oil Burner

The Bethlehem Foundry and Machine Company, Bethlehem, Penna., announce two new oil burners—a model CE conversion burner, and a model FE flange type burner.

The "Monitor" motor-fan-pump unit is removed bodily for service and a duplicate unit is installed in a few minutes. All operating mechanism is carried on a single shaft. Patented live rubber cradle mounting supports



the motor-fan-pump unit and hermetically seals the unit into the burner housing and isolates mechanical sound.

The patented improved Rotaire diffuser provides suspension and mixture of oil and air while the "rolling" flame form provides efficient heat transfer in any type furnace. The single-bracket nozzle electrode assembly is easily removed for cleaning or adjustment without disturbing any other part of the burner.

◆

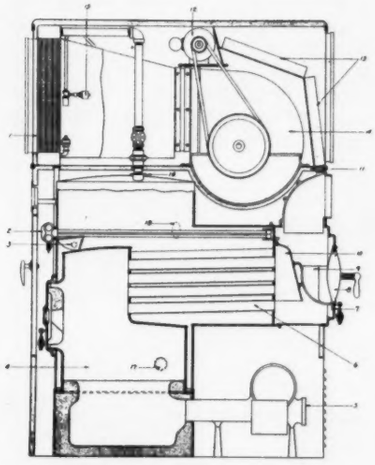
● 48—Cable Accessories

General Electric Company, Schenectady, New York, has announced a line of portable cable accessories, in recognition of the increased use of portable electric equipment. These include high-voltage cable couplers and molded terminals for all voltages. These new cable products are designed to incorporate safety, long wear, and convenience in the field.

New Products . . . . . .

49—Conditioner

Fitzgibbons Boiler Co., Inc., 570 Seventh Ave., New York, announces a new boiler-air conditioner which cleans, humidifies, tempers, circulates the air and furnishes year-round hot water. The boiler section is built of copper bearing steel with a copper tube and fin type heating coil and a



submerged hot water heating coil. Any standard gun type oil burner may be used. A large number of tubes in the radiator section insures low stack temperature and economical heating cost. The boiler is completely insulated and cased in an enameled jacket. The double wheel type blower is mounted in the upper section of the conditioner, with filters above and at face. A spray type humidifier is placed in front of the exchanger. Capacities range from 130,000 to 164,000 B.t.u.

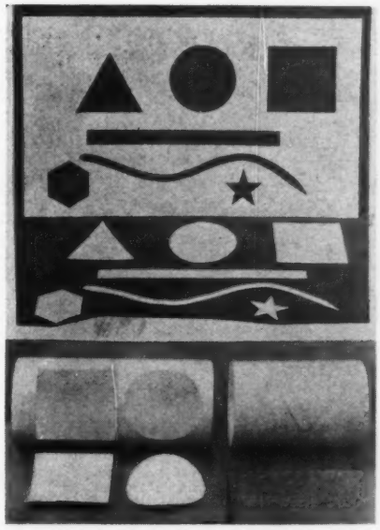
◆

50—Filter

Staynew Filter Corporation, Rochester, New York, is announcing Model A automatic air filter for all ventilating purposes in Bulletin 120.

The principle of design is the provision of four successive stages of filtration in the form of two endless curtains, arranged to rotate in such a manner that the face of the curtain, on the dirty air side, will be thoroughly cleaned, before returning to the clean air side. The filter curtain consists of panels of wire cloth to which are attached successive layers of knitted copper mesh. These panels are attached to an endless curtain of wire cloth, reinforced with steel rods, to prevent any possibility of buckling when air is passing through. The ends of the horizontal rods are secured to ⅜ in. pitch roller chain, which passes over sprockets attached to shafts and insures a positive movement.

Operating mechanism consists of a ⅙ H.P. motor.



● 51—New Cutting Tool

The photographs with this item illustrate work which can be done using a new cutting tool developed by Ralph W. Poe, 44 White Ct., Canton, Illinois. The tool is made to be used with a hammer, the point of the tool so designed as to penetrate the metal without distorting or stretching the metal. This tool can be used for cutting material up to 16 gauge and leaves both edges smooth. Holes of any shape or size down to two-inch radius in 18 gauge or one-half inch radius in lighter gauge can be cut. It is necessary to clamp small pieces to be cut in a vice or brake in order to hold while cutting, but larger pieces have sufficient weight so that they do not need to be so held. The tool can be used for cutting all sorts of holes in corrugated iron, and can be used for cutting square or rectangular holes in furnace casings, and formed pieces as shown. Corrugated conductor pipe and outlet holes in gutters can be cut.

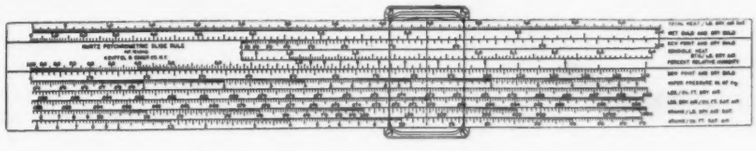
◆

● 52—Psychrometric Slide Rule

The Keuffel & Esser Company, Hoboken, New Jersey, is adding the Kurtz psychometric slide rule to its line of slide rules. This rule solves the same problems as the psychrometric charts and tables, and affords a means of determining any or all of the psychrometric values for any air conditioning problem.

The rule is so arranged that if some two of the four fundamental psychrometric factors—i.e., dry bulb temperature, wet bulb temperature, dew-point temperature and relative humidity—are known, the other two may be determined by one or two settings of the slide. In addition, these values may be read directly from dry bulb temperature: pounds of dry air per cubic foot of dry air and sensible heat in B.t.u. per pound of dry air. From wet bulb temperature: total heat in B.t.u. per pound of dry air in a saturated mixture. From dew-point temperature: vapor pressure in inches of mercury, (hg), pounds of dry air per cubic foot of saturated air, grains of moisture per pound of dry air saturated with moisture, and grains of moisture per cu. ft. of saturated air.

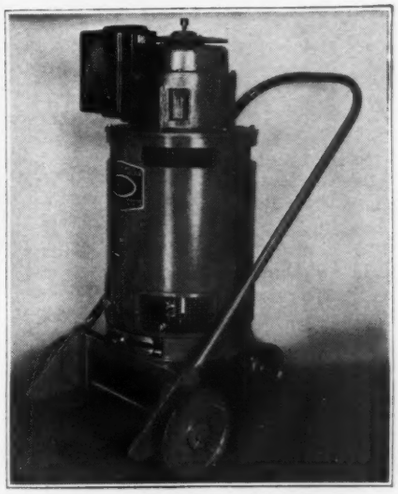
The rule is 11x1⅝ in. and it is finished in white enamel with black figures. It is based upon the standardly used barometric pressure of 29.92 in. of mercury.



53—75-Amp. Welder

A new 75-ampere vertical welder is announced by the Harnischfeger Corporation, Milwaukee, featuring stable high speed arc, accomplished through combining the magnetic bridge as a part of the main pole assembly and spreading pole shoes wider around the holes in which the stabilizer coils are embedded.

Mounted atop the generator is a heavy duty 5 Hp squirrel cage motor of dripproof construction. This fan-cooled motor is operated by push buttons and equipped with no-voltage re-



lease and overload protection. Connections are available for 110 to 550 volts or for special voltages of 2 and 3 phase, 60 and 50 cycles. Single control is provided for current settings over the entire welding range to reduce dependence on the human element. The unit is capable of handling work as light as 24 gauge. It is 15½" in diameter, 41" high and weighs 600 pounds.

New Products . . . . . .

54—Conditioner

Reif-Rexoil, Inc., Buffalo, New York, announces the Rexoil Air Conditioner with mixing dampers in a special bonnet which permits 70 degrees in one room, 72 in another and higher or lower degrees in other rooms.

The unit consists of a steel furnace, oil burner, blower, sprays and filters. There are two sizes—125,000 and 200,000 B.t.u. rating.

An 8-page 8½x11 illustrated folder fully describes the unit.

◆

55—Day-Nite Controls

Penn Electric Switch Co., Des Moines, Iowa, announces a new all-electric system of fully automatic day-nite control incorporating two new controls. One new control is the Type 770 Tem-Clock, a custom-built electric switching clock with heavy duty Telechron movement and built-in switch for fully automatic control of set-back temperature. The other new control in the system is the Type 860 Day-Nite Imperial Temtrol, the newest of the Penn heat anticipating room temperature controls.

Tem-Clock operates on low voltage (25 volts) and controls set-back temperatures, day or night, as desired, through a low voltage electrical connection to the Temtrol. This permits Tem-Clock to be mounted on the wall at eye level with Temtrol mounted in the four foot zone.

◆

56—Oil Fired Furnace

The Henry Furnace & Foundry Company, Cleveland, Ohio, announces two new oil fired air conditioning units, the improved Moncrief "Aristocrat" Oil Fire Air Conditioning System and the Moncrief "Special" Oil Fire Air Conditioning System.

The new "Aristocrat" is a re-design of the former air conditioner of the same name. The oil burner is now completely enclosed. The new design includes the patented Wind Box for distributing air uniformly over the heating surfaces.

The Moncrief "Special" Oil Fire is a brand new unit, specially designed for small homes. There are two sizes with fuel capacities of three-fourths of a gallon per hour and one gallon per hour.

Neither the "Aristocrat" Oil Fire nor the "Special" Oil Fire Systems are furnished with oil burners.

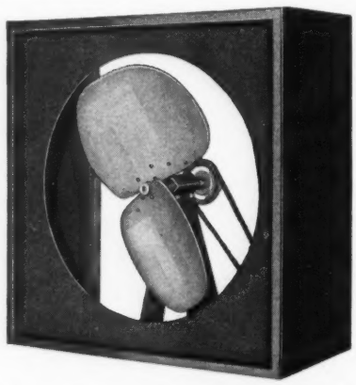
◆

57—Gas Burners

The Barber Gas Burner Company, 3704 Superior Avenue, Cleveland, Ohio, is just completing the development of 36 new burner unit models with four different types of jets. They say these burners are adaptable to a wide range of gas-burning appliances.

58—Air-Flow Ventilator

National Fan & Blower Corporation, Chicago, Illinois, announce the National "Air-Flow" Home Ventilator, a two-bladed propeller-type, belt drive fan with motor enclosed in a housing which can either be installed at an outside window or outside wall or placed above openings from the rooms

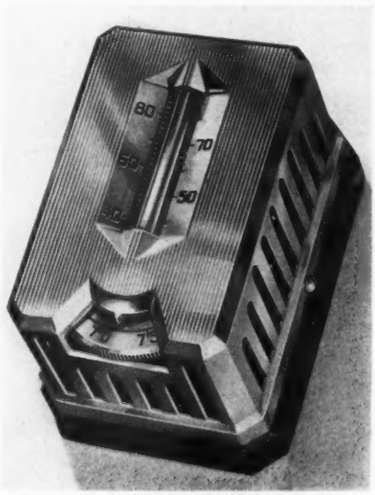


below. The company announces that the fan has been designed upon the basis of 30, 40 or 50 air changes per hour, according to geographical location and the c.f.m. capacity ranges from 3,500 to 12,000. Literature showing and describing the unit and fundamental principles of attic ventilation is available.

◆

59—Room Thermostats

The Spencer Thermostat Company, Attleboro, Massachusetts, announces a full line of new and improved room thermostats. A feature is the concealed contacts fully protected from all dust. The units are made with a dead front with no live parts exposed. These



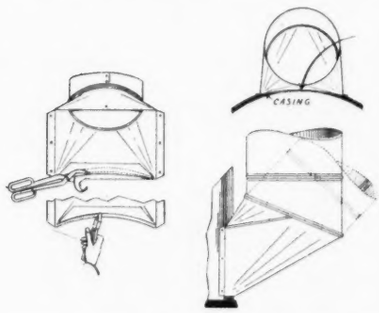
thermostats are for 250 volt service or 125 and low voltage (30 and less).

The thermostats are built in three types; standard, heat accelerator, and an outside compensated cooling control unit and in regular wall mounting, or with mounting accessories for special outlet box, conduit connection wall plate for over-the-surface mounting and standard switch box with plain or switch plate. The heater of these units is the corrugated KLIXON disc thermostatic element.

◆

60—Cold Air Boot

Howe & Bassett Co., Inc., 840 University Avenue, Rochester, New York, is distributing a small four-page folder with space for the dealer's imprint, describing and illustrating the new Junior Fitall Cold Air Boot for rapid installations. The boot, they say, eliminates scribing for casing as each boot is premarked with a paper template in the boot bottom. The template is marked with all the conven-



tional casing curves. To fit the boot to the casing, it is only necessary to select the proper casing curve and cut ⅜ in. outside of this line. The edge is then bent downward with pincers on the selected line as shown. The upper lip of the boot is flexible and is self conforming to the casing curve, requiring no cutting or fitting. In addition, all necessary holes for attaching the boot to the furnace casing are punched and the flanges are bent already for attaching. The boot is adjustable from a 90 to a 45 deg. position, thus making it possible to make the round pipe connection from a number of different angles.

◆

61—Conditioning Furnace

The Rybolt Heater Company, Ashland, Ohio, announces the new Series 150 Rybolt air conditioning unit, combining in one casing a cast iron furnace with a one-piece radiator and latest style slip-on front construction, two-piece corrugated fire bowl, improved ball-bearing duplex grate, in Btu output capacities ranging from 77,000 to 186,000, based on a combustion rate of 6½ pounds per hour. The square casing, of heavy-gauge sheet metal, is finished in green Morocco baked enamel. Heating element is surrounded with an inner casing extending from floor to plenum chamber. The attached blower-filter compartment houses a forward curve, centrifugal-type blower with variable speed drive and belt-connection to motor; two to four filter sections; with a capacity from 1,000 to 2,500 C. F. M.

With the Manufacturers . . .

Stove Pipe Display Rack

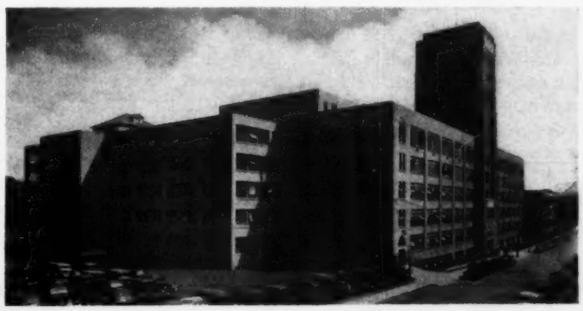
The new stove pipe display rack, made by the Milcor Steel Company, is a merchandising medium designed to step up stove pipe sales. It is made of 100 point Bristol

Board, lined with buff covering and process-enameled in five colors. The rack is easily assembled and is sturdily built. It will support three full joints of stove pipe and samples of corrugated and adjustable elbows. It can be used for floor, window or counter.

◆

Minneapolis-Honeywell Research Facilities

Shown is a picture of the newly enlarged Minneapolis-Honeywell Regulator Company plant and main office at Minneapolis. The wing extending away from the street on the left of the picture is a newly completed addition which provides nearly 50 per cent more floor space. On the top of the new wing is an experimental bungalow, a frame structure built to the usual specifications for dwellings in that territory, insulated in the normal manner and with the usual construction used throughout. There provision



has been made for heating, either by warm air, steam, or hot water, and it is equipped with the necessary duct work for air conditioning. Directly beneath the house is the test department of the engineering division in which are located boiler, furnace, and air conditioning equipment by means of which any desired method of heating or air conditioning may be applied to this house for experimental purposes. Three complete air conditioning installations have been made to provide air conditioning for the offices and engineering department on the entire sixth floor, and a portion of the fifth floor. Cooling apparatus in these installations has capacity the equivalent of 248½ tons of refrigeration.

◆

H. R. Goodwin Joins Youngstown

Harold R. Goodwin, widely known in the Detroit territory where he has been engaged in the sale of plumbing materials for 20 years, has joined Youngstown Sheet & Tube Co. sales organization at Detroit.

With the Manufacturers . .

Death of Paul E. Cash

Paul E. Cash, vice president of the Williamson Heater Company, Cincinnati, Ohio, passed away on April 24.

◆

Death of E. M. Brennan

Edward M. Brennan, associate of the Armstrong Furnace Company, Columbus, Ohio, died on April 24.

◆

G. A. Voorhees Joins Schwitzer-Cummins

G. A. Voorhees, one of the best known residential heating and air-conditioning engineers in the warm air heating industry, has joined the Schwitzer-Cummins Company of Indianapolis, as chief engineer in the Blower Division. Mr. Voorhees is well known to most readers as the author of some of the outstanding contributions to engineering data published in AMERICAN ARTISAN during the last six years. He is also the author of the Engineering Bulletins of the Furblo Institute published during his service as chief engineer of that company. Louis Schwitzer, Jr., is vice president of the company and manager of the Blower Division. The Schwitzer-Cummins Company supplies blower wheels and complete blower assemblies for a number of leading manufacturers of various types of heating, ventilating and air conditioning equipment. The Blower Division is being expanded and will include a new two-story addition constructed of glass building blocks.

◆

Emrich Co. Joins N. W. A. H. & A. C. Ass'n

C. Emrich Company, 127 W. Fulton Street, Columbus, Ohio, has become a member of the National Warm Air Heating and Air Conditioning Association.

◆

Dedicates New Trane Factory

Reuben N. Trane, President of the Trane Company, heating and ventilating manufacturers of La Crosse, Wisconsin, inaugurated a new addition to plant No. 2 of the company's properties Saturday, April 11, at noon.

FOR YOUR CONVENIENCE

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Please ask the manufacturer to send me more information about the equipment mentioned under the following reference numbers in "New Products" and "New Literature." (Check numbers in which you are interested):

43	44	45	46	47	48
49	50	51	52	53	54
55	56	57	58	59	60
61					
257	258	259	260	261	262
263	264	265	266	267	268
269	270	271	272	273	274
275	276	277	278	279	280
281	282	283	284	285	286
287	288	289	290	291	

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EASTERN DISTRIBUTOR for well-known line of warm air furnaces and furnace pipe and fittings wants experienced, intelligent man to handle complete sales setup in exclusive territory, including Central New York State between and including Syracuse and Albany, and from Canadian border to Pennsylvania State line. This is a real opportuity for a go-getter. Write or wire GREAT EASTERN DISTRIBUTORS, INC., Utica, N. Y.

WELL KNOWN furnace blower manufacturer is seeking an engineer. Must have practical experience with warm air heating, both gravity and with blowers. Must be a good correspondent able to handle both engineering and sales correspondence. Give full particulars in first letter, state salary desired, references, when available, etc. Do not reply unless confident you can handle the job. Address Key 374, "American Artisan," 6 N. Michigan Ave., Chicago.

EXCELLENT OPENING for Master Plumber. State age and references. Must be good, neat workman. Sober. Write H. M. Gaddis, Palestine, Illinois.

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CHICAGO STEEL BRAKES, 10' 14; 10' 16; 10' 18; 8' 16; 8' 14; 8' 18
SHEARS, POWER, 36" 18; 52" 14; 42" 10; 8' ¼" 12' 14; 10' 3/16"; 156"x5/16"
SHEAR, POWER, 10' 18 ga. Stoll, $575.00
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SHEARS, Foot, 30"; 36"; 42"; 52"; 62"; 96"

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June, 1936


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